POLLEN ANALYSIS OF TAIWAN PLIOCENE (II)

— Yunshuichi Section[1]

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Abstract: Fifty-seven samples taken from the Yunshuichi section in southwestern Taiwan are palynologically analyzed; six new genera, fifty-two new species, five new records and two new combinations are proposed. The new angiospermous taxa in this study are compared with Muller's review. These new taxa accord with the time course of appearance with several areas outside Taiwan, but *Fagraea* and *Patrinia* types have not been sufficiently documented in the past.

Some taxa, *e.g. Tilia, Pterocarya, Carya, Ephedra*, etc., are absent in the present flora of Taiwan, but are still living in southeastern mainland China; therefore, the Pliocene vegetation of Taiwan might be, in part, similar to the present vegetation of southeastern mainland China.

Two pollen assemblages, *i.e.*, Subalpine-Temperate and Subtropical-Tropical assemblage are utilized to subdivide the pollen zones. Seven pollen zones are determined, the climate became warmer in Zone II; wet and hot in Zone V; cold and dry in Zone VI; prominent temperature changes from warm to cold, then warm to cold again, occurred in Zone VII. Zone VII, therefore, may belong to the Early Pleistocene stage.

Reworked palynomorphs from Cretaceous and Early Tertiary deposits are commonly found. Based on the appearance of these reworked palynomorphs, including *Dinogynium*, a widespread marine dinoflagellate in upper Cretaceous, the presence of outcrops of Cretaceous marine deposits in the sedimentary cycle of Yunshuichi section can be inferred.

INTRODUCTION

Most palynological research in Taiwan is done with the Quarternary and Miocene sediments that are located in northern and central Taiwan (Huang, 1981, Table 2), except one previous work by Huang & Tsou (1984). Accordingly, it is still necessary to obtain Pliocene palaeopalynological data to understand the palaeoclimates, geochronology and palaeoecology of Taiwan since the Miocene.

Ho (1975) reported that the Pliocene rocks in Taiwan are distributed in the hills and lowlands on the west of the exposed Miocene strata in the western foothills; they become progressively thicker and are much finer and shalier toward southern Taiwan.

Since the early part of this century, the possibility of the existence of com-

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mercially valuable natural gas and oil deposits in the Chiayi and Hsinying areas, the central part of Southwestern Taiwan, has been realized (Stach, 1957). Much research has been carried out in this area: Chang (1964), Chang *et al* (1956), Stach (1957) and Wu (1968) for the geological surveys, and Chi (1980) and T. Y. Huang (1978) for the biostratigraphic studies. Thus, the abundant geological data facilitates palynological study in this area.

The Yunshuichi section, which includes the Pliocene type sections of Chunlun Formation, Niaotsui Formation and Yunshuichi Formation in southern Taiwan (Stach, 1957), was used to do the palaeopalynological biostratigraphy research (pollen assemblage zones) reported in the present study.

The aims of this paper are to report the taxonomical findings of fossil palynomorphs of southern Taiwan and to discuss the vegetation and climatic change from the late Miocene to the Early Pleistocene on the basis of the pollen diagrams derived from the Yunshuichi section.

MATERIALS AND METHODS

(1) Materials

Along Yunshuichi, 157 samples were collected between Yunshui and Chunlun village (Fig. 1). Approximately 500 g of rock per sample was taken and put into labeled bags. They were brought back to NTU's palynological laboratory for extraction of palynomorphs. The samplings mainly consist of interbedded shale and sandstone.

(2) Methods

(i) Extraction and observation of palynomorphs:

The preparation procedure varies depending on the nature of the rocks. Referring to the methods of Brown (1965), Chung & Huang (1972) and Dolher (1980), the following treatment sequence is found to be the most efficient.

1. Clean the rock.
2. Break down the rock to 0.5 mm³.
3. Remove the silica and silicates by 47% HF for 3 days.
4. Rinse with hot 10% HCl.
5. Oxidize the organic residues by Schulze's solution.
6. Separate the organic residues by zinc chloride flotation.
7. Rinse with 10% HCl.
8. Centrifuge shortly to remove the fine debris.
9. Mount in pure glycerine.

Fifty-seven of the 157 samples were choosen for examination of palynomorphs. The palynomorphs were counted and photographed with a Nikon-L-Ke type microscope. The entire cover slide area was examined under a 300× magnification; the 1000× magnification was used for critical determinations. Magnifications of 600× and 1000× were used for photographing.

Identification was established by consulting Boros & Tarai-Komlodi, 1975; Chaw, 1980 (M. S. thesis); Huang, 1972, 1978a, 1978b, 1978c, 1979, 1980b, 1981a, 1981c; Ikuse, 1965; Jansonius & Hills, 1976, 1979; Kremp & Kawasaki, 1972; Krutzsch, 1971; Shaw & Huang, 1983. All the palynomorphs were recorded and more than

400 pollen grains and spores were identified in each sample. They were classified into three main categories, namely, angiospermous pollen, gymnospermous pollen and pteridophytous spores.

(ii) Preparation of pollen diagrams:

The percentage sum for the right-hand side of the diagram (Figs. 2-3) includes all pollen grains and spores identified except the reworked ones. The taxa which showed a percentage greater than 1.5 were plotted in Fig. 2. In Fig. 3 the climatically meaningful pollen types (indicators) in Taiwan were grouped into two assemblages. Where the pollen type grows in both climatic zones, the assemblage is attributed to the zone in which it grows most frequently. The lithology column used in the diagrams is adopted from Hsiao (1955) *ex* Stach (1957).

RESULT

(1) Taxonomy of palynomorphs

More than 25,000 palynomorphs were recorded, and 23,451 pollen grains and spores were identified. The percentage of the identified bryophytous and pteridophytous spores was 17.6% including 53 genera, 85 species and 3 varieties; gymnospermous pollen grains constituted 31.5%, including 13 genera and 30 species; and angiospermous pollen grains 50.8%, including 67 genera and 76 species (Tables 1-2, pls. 1-36).

The bryophytous spores (pl. 37) couldn't be easily identified due to the lack of reference data on Taiwan on the one hand, and the similarity of exine ornamentation in different taxa on the other. Other types of palynomorphs were grouped into fungal elements (pl. 38), cyst of Dinoflagellates (pls. 39, 40) and foraminiferal inner test (pl. 40); they were shown by plates without further identification and description.

Fifty-nine new taxa (Table 2) are described as follow:

(i) Bryophytous and pteridophytous spores including one new genus, 25 new species, two new records and one new combination:

1. CONISPORITES *gen. nov.* 錐突孢屬

Type species: *Conisporites taiwanensis* Huang & Huang.

Diagnosis: "Large spores, subcircular; exine with scabrate and non-segmented conical processes on both surfaces."

Note: This genus differs from *Conipollenites* Cameron 1974 by its non-segmented conical processes on both surfaces, not papillate sculpture and much larger size (Jansonius & Hills. 1976).

(1) **Conisporites taiwanensis** *sp. nov.* 臺灣錐突孢

"Spores subcircular, 116×95 μ; exine 3-4 μ thick, with scabrate and non-segmented conical processes, the elements 18-23 μ long, 6-10 μ wide."

Locality: Chunlun Formation.

Slide: 124-S (Pl. 1, Fig. 1, holotype).

Taxonomic affinity: Unknown.

2. CORRUSPORIS Krutzsch 1967 摺凸孢屬

Type species: *Corrusporis tuberculatus* Krtz.
Diagnosis: "Alete microspores; globular; amb circular; uniformly covered with various elements, such as verrucate, baculate, gemmate or tuberculate elements." M. Oligocene Germany.

(2) **Corrusporis taiwanensis** *sp. nov.* 臺灣摺凸孢

"Alete spores; amb circular to subcircular, 47–70 μ wide (including sculpture), the sculpture elements mainly baculate and gemmate, varying in density and size, a 'slit' may be seen in some samples."
Locality: Chunlun Formation.
Slide: 116-3L, 124-S (Pl. 1, Fig. 2, holotype), 134-1L.
Taxonomic affinity: This spore type resembles to extant alete, gemmate, moss spores.

3. STRIAMONOLETES Mathur 1966 條紋單裂孢屬

Type species: *Striamonoletes parallatus* Math.
Diagnosis: "Striate monolete spores".

(3) **Striamonoletes digitatus** *sp. nov.* 臺灣條紋單裂孢

"Striate monolete spores, approximately bean-shaped, 23×60 μ; exine striate, the ribs 1 μ wide, the grooves 0.5 μ wide, the striate running oblique to monolete mark, with scabrate to verrucate processes in lateral view."
Locality: Liuchungchi Formation.
Slide: 11-1R (Pl. 2, Fig. 1-2).
Taxonomic affinity: This palynomorph is very similar to the extant species of *Actinostachys digitata* Wallich of the Schizaeaceae (Huang, 1981a: Pl. 24: 6-8).

4. ANTHOCERISPORIS Krutzsch 1963 角蘚孢屬

Type species: *Anthocerisporis europaeus* Krtz.
Diagnosis: "Trilete microspores with sculpture differently developed on both hemispheres, distally echinate, proximally broad indistinct reticulum (may be abscent), Y-mark delicate." Oligocene-Miocene, Germany.

KEY TO THE SPECIES OF *Anthocerisporis*

1. Sexine with reticulate sculpture.....*A. reticulatus*
1. Sexine without reticulate sculpture
2. Spores less than 28×32 μ.....*A. taiwanensis*
2. Spores more than 45×40 μ.....*A. formosensis*

(4) **Anthocerisporis taiwanensis** *sp. nov.* 臺灣角蘚孢

"Trilete spores; amb subtriangular with rounded angle, 23-28×22-32 μ; laesural arms extending to the equator; exine 1 μ thick, with echinate sculpture in lateral view, the echini 0.5–1 μ long."
Locality: Yunshuichi Formation.
Slide: K2-1R, 26-1L (Pl. 2, Fig. 7–8, holotype), 85-1L.
Taxonomic affinity: This species is resemble to the extant species of *Phaeoceros* of the Anthocerotaceae.

5. APPENDICISPORITES Weyland & Krieger 1953 長角三裂孢屬

Type species: *Appendicisporites tricuspidatus* Weyland & Greifeld in Weyland & Krieger.

Diagnosis: "Trilete spores; amb triangular, with short or in part very long rod-like, horn-shaped or tap-root-like angular appendages; exine with a modest number of ridges that may be parallel to the sides, ridges of uniform development, not often branching." U. Cretaceous (Senonian) Germany.

(5) **Appendicisporites taiwanensis** *sp. nov.* 臺灣長角三裂孢

"Trilete spores; amb triangular, 45×55 μ (without appendages), with two short and one long horn-shaped angular appendages; laesural arms reach the equator; exine with 4–5 ribs in each side; appendage up to 30 μ long, 15 μ wide at the base, with sinuate margin."

Locality: Chunlun Formation.

Slide: 132–2L (Pl. 3, Fig. 6–7).

Taxonomic affinity: This species is related with the extant and fossil species of *Anemia* of the Schizaeaceae. (Bolkhovitina, 1961).

Note: This palynomorph is possibly reworked from Cretaceous sediments.

6. CIBOTIUMSPORITES Rouse 1957 金狗毛孢屬

(6) **Cibotiumsporites barometz** *sp. nov.* 巴羅梅兹金狗毛孢

"Trilete spores; amb subtriangular, the side straight or slightly convex, 55×40–45 μ; laesural arms 18–20 μ long, with laesural ridge, 4–5 μ wide; equatorial ridge smooth, margin slightly undulated.

Locality: Yunshuichi Formation.

Slide: K4–1R, 64–1R (Pl. 3, Fig. 5, holotype).

Taxonomic affinity: This species is very similar to the extant *Cibotium barometz* (L.) J. Smith of the Dicksoniaceae (Huang, 1981a pl. 30:1–4).

Note: Equatorial ridge is absent in *C. cumingus*.

7. CICATRICOSISPORITES Potónié & Gelletich 1933 環肋孢屬

(7) **Cicatricosisporites formosensis** (Huang) C.L. Huang & T.C. Huang *nom. nov.* & *transfer nov.* 寶島環肋孢

Synonym: *Plicatella taiwaniana* Huang, Taiwania **23**: 45, *pl. 23: 5–6*. 1978. The same palynomorphs were also found in Liuchungchi, Yunshuichi and Chunlun Formation, the emended description of this species is as follow: "Trilete spores, amb triangular, 45–58×40–48 μ; laesural arms 20–23 μ long, 3/4 radius; distal surface with 3–4 subparallel ribs, proximal surface with reticulate sculpture, which can be seen clearly in equatorial view."

Note: This species differs from *C. taiwanensis* and *C. anstraliensis* by the short appendices on the angles in the polar view.

8. CONCAVISPORITES Pflug in Thomson & Pflug 1953 凹邊孢屬

Type species: *Concavisporites rugulatus* Pflug.
Diagnosis: "Trilete spores, mostly smooth, less commonly structured; usually both, but less commonly either; torate and/or concavely triangular." Paleocene, L. Eocene.

(8) **Concavisporites colliculosus** *sp. nov.* 背凸凹邊孢

"Trilete spores; amb triquete with protruded round corner, 50×50 μ; laesural arms undulate extending to the equator; kyrtomes well developed on proximal surface; exine 1.5 μ thick, psilate in lateral view."
Locality: Yunshuichi Formation.
Slide: 94-1L (Pl. 4, Fig. 6-7).
Taxonomic affinity: Unknown.
Note: This palynomorph is possibly reworked from Early Tertiary sediments. This species differs from C. crassexinius Nilsson (Schuurman, 1977, pl. II: 1.4) by the protruding rounded corners.

9. LEIOTRILETES Naumova 1939 *ex* Ishchenlo 1952 平滑徑三裂孢屬

(9) **Leiotriletes magnus** *sp. nov.* 太平滑徑三裂孢

"Trilete spores; amb subtriangular, 60-75×58-60 μ; laesural arms 26-33 μ long, over 3/4 radius; exine 2-3.5 μ thick, psilate in lateral view."
Locality: Chunlun Formation.
Slide: 31-1R, 144-1L (Pl. 3, Fig. 8-9, holotype).
Taxonomic affinity: This species is similar with the extant *Lygodium japonicum* (Thunberg) Swartz of the Schizaeaceae (Huang. 1981a pl. 23: 3-4)

10. LYCOPODIACIDITES Couper 1953 石松孢屬

Type species: *Lycopodiacidites bullerensis* Couper.
Diagnosis: "Trilete spores; amb triangular to sub-circular; proximal face with reduced sculpture, distal face with varied sculpture; Y-mark long." Jurassic, New Zealand, common.

(10) **Lycopodiacidites infragranulatus** Mädler 下顆粒紋石松孢

"Trilete spores; amb subtriangular, 72×62-70 μ; laesural arms 22-25 μ long; exine 1.2-1.5 μ thick, with rugulate sculpture in surface view."
Locality: Yunshuichi Formation.
Slide: 69-4R (Pl. 4, Fig. 8-10).
Taxonomic affinity: This species is related to the extinct taxa of the Lycopodiaceae (Schuurman, 1977. pl. VI: 5-7).
Note: *Rugutriletes* Pierce 1961 and *Camarozonosporites* Pant *ex* Potonié 1956 are much smaller (Jansonius & Hills, 1976). This species is possibly reworked from older sediments.

11. MICRORETICULATISPORITES Knox 1950 小網紋三裂孢

Type species: *Microreticulatisporites lacunosus* (Ibr.) Knox.
Diagnosis: "Spores spherical to triangular or oval; 14–70 μ in diameter; ornamentation reticulate with fine small mesh, not more than 6 μ across.

(11) **Microreticulatisporites taiwanensis** *sp. nov.* 臺灣小網紋三裂孢

"Trilete spores; amb elliptic, 50–55×50 μ; laesural arms 17 μ long; exine 1–1.5 μ thick, the lateral view with scabrate sculpture, the surface view reticulate, the lumina ca. 1 μ wide."
Locality: Chunlun Formation.
Slide: 146-1L (Pl. 5, Fig. 11–12).
Taxonomic affinity: Unknown.
Note: This species is characterized by the reticulate sculpture.

12. POLYPODIACEOISPORITES Potonié 1951 鳳尾蕨孢屬

KEY TO THE SPECIES OF *Polypodiaceoisporites*

1. Equatorial ridge baculate.....*P. baculatus*
1. Equatorial ridge not baculate
  2. Equatorial ridge evenly thick
    3. Amb ellipsoidal.....*P. intragigantibalticus*
    3. Amb subtriangular
      4. Spores 21–24×24–27 μ; equatorial ridge, 2 μ wide..*P. microconcavus*
      4. Spores 30–40×36–50 μ; equatorial ridge, 3 μ wide..*P. gracillimus*
  2. Equatorial ridge unevenly thick
    5. Angle thicker than side
      6. Amb triquete, the side concave, the angle emarginate; exine extervermiculate on both surfaces.....*P. taiwanensis*
      6. Amb subtriangular, the side straight, the angle rounded or truncate; exine rugulato-reticulate on distal face.....*P. semipinnatus*
    5. Angle thinner than side, obtuse or acute
      7. Circumfluent field-distal ridge present
        8. Distal ridge baculate.....*P. nipponicus*
        8. Distal ridge not baculate.....*P. bellus*
      7. Circumfluent field-distal ridge absent
        9. Equatorial ridge annulotrilete; laesural ridge circumfluent.....*P. dictylinus*
        9. Equatorial ridge annulate; laesural ridge not circumfluent
          10. Side convex
            11. Elements prominent on both faces
              12. Angle less than 2 μ thick, acute
                13. Spores 22–28×21–29 μ; side 3.5–4 μ wide; proximal irregularly sinuous laesural ridge present.....*P. microconvexus*

13. Spores 37–40×35–43 μ; side 2–4 μ wide; laesural line-like ..... *P. multifidus*
12. Angle obtuse
14. Angle 1.5–2 μ thick ..... *P. wallichianus*
14. Angle more than 2 μ thick, obtuse; spores 10–38×34–40 μ; side 3–4 μ wide; laesurae with proximal irregularly sinuous ridges ..... *P. intrabalticus*
11. Elements prominent on proximal face only... *P. microformis*
10. Side concave or straight
15. Elements with rounded apices ..... *P. ensiformis*
15. Elements without rounded apices
16. Amb triquete; side 6–7 μ wide; angle 2–5 μ thick, acute or emarginate; spores 40–44×40–50 μ..... *P. emarginatus*
16. Amb subtriangular; side 3–5 μ wide; angle obtuse
17. Spores 32–35×31–37 μ; angle 2–3 μ thick; side 3–4 μ wide..... *P. setuloso-costulatus*
17. Spores 34–40×40–41 μ; angle 3.5–4 μ thick; side 4–5 μ wide ..... *P. venustus*

(12) **Polypodiaceoisporites baculatus** *sp. nov.* 棒紋鳳尾蕨孢

"Trilete spores; amb subtriangular, 55–65×40–50 μ; distal surface with baculate elements, the elements 3–4 μ long, 3–4×2–3 μ wide; equatorial and distal ridges undulated."

Locality: Kanhsialiao Formation.

Slide: K6–3 (Pl. 5, Fig. 2, holotype), 3–1L, 64–2R.

Taxonomic affinity: This species is similar to *Onychium siliculosum* (Desvaux) C. Christensen of the Pteridaceae (Huang, 1981a pl. 66: 6–9).

Note: This species is characterized by the large baculate elements on the distal hemisphere.

(13) **Polypodiaceoisporites ensiformis** *sp. nov.* 箭葉鳳尾蕨孢

"Trilete spores; amb subtriangular, 35–45×28–35 μ; exine with elliptic tuberculate and baculate processes, the elements with rounded apices, the element denser on distal face, 3–4 μ long; equatorial ridge with undulated margin; distal hemisphere much larger than the proximal hemisphere."

Locality: Liuchungchi Formation.

Slide: 3–3L (Pl. 6, Fig. 1–2, holotype), 131–2L.

Taxonomic affinity: This species is similar to extant *Pteris ensiformis* Burman of the Pteridaceae (Huang, 1981a pl. 68: 8–11).

Note: This species is characterized by the rounded apices of element and large distal hemisphere.

(14) **Polypodiaceoisporites nipponicus** *sp. nov.* 日本鳳尾蕨孢

"Trilete spores; amb subtriangular, the side slightly convex, 45–50×40–43 μ; laesural arms 13–15 μ long; both surface extervermiculate and baculate, the bacula scattered along the distal ridge."

Locality: Yunshuichi Formation.
Slide: 49-3R, 64-1R, 94-2R (Pl. 6, Fig. 5, holotype).
Taxonomic affinity: This species is similar to *Pteris nipponica* Shieh of the Pteridaceae (Huang 1981a pl. 70: 1-2).
Note: This species is characterized by its large bacula on distal ridge.

13. PUNCTATISPORITES Ibrahim 1933 穿孔紋孢屬

Type species: *Punctatisporites punctatus* (Ibr.) Ibr.
Diagnosis: "Trilete spores; exine surface appears to have fine sandy texture."

(15) **Punctatisporites formosensis** *sp. nov.* 寶島穿孔紋孢

"Trilete spores; amb rounded triangular, 45-53×43-50 μ; laesural arms 16-18 μ long, line-like margo; exine 1.5-2.5 μ thick; sexine punctate."
Locality: Liuchungchi Formation.
Slide: 15-2L (pl. 6, Fig. 9-10, holotype), 106-1R, 112-2L.
Taxonomic affinity: Unknown.
Note: This species is different from *Granulatisporites taiwanensis* Shaw & Huang in punctate sculpture and larger size.

14. RUDOLPHISPORIS Krutzsch 1963 魯道夫角蘚孢屬

Type species: *Rudolphisporis rudolphii* (Krtz.) Krtz.
Diagnosis: "Trilete microspores with basic reticulate-foveolate sculpture; amb subcircular; proximal reticulation is more pronounced." L. Miocene, North Bohemia.

(16) **Rudolphisporis taiwanensis** *sp. nov.* 臺灣魯道夫角蘚孢

"Trilete spores; amb subtriangular to subcircular, 43-46×32-38 μ; laesural arms 15 μ long; exine 2-3 μ thick, with echinate and foveolate sculpture; pits ca. 2-3 μ wide, the echini ca. 3-5 μ long."
Locality: Niaotsui Formation.
Slide: 68-2L, 112-1R (Pl. 7, Fig. 1-2, holotype).
Taxonomic affinity: This species is related to the extant species of *Anthoceros* of the Anthocerotaceae (Jarzen, 1979 pl. I, II).

15. SAXOSPORIS Krutzsch 1963 劍刺孢屬

Type species: *Saxosporis duebenensis* Krtz.
Diagnosis: "Trilete spores, uniformly ornamented with warty or elongated to spiny elements; amb subcircular to subtriangular; Y-mark more or less delicate, never dead straight; rays usually long." L. Miocene, Germany.

(17) **Saxosporis taiwanensis** *sp. nov.* 臺灣劍刺孢

"Trilete spores; amb ovoid, 40×28-30 μ; laesural arms 13-15 μ long, nearly extending to equator; exine 1 μ thick, with echinate to coniculate sculpture, the element 3-5 μ long."
Locality: Yunshuichi Formation.
Slide: 53-1R (Pl. 7, Fig. 7-9).
Taxonomic affinity: This species is similar to *Selaginella ciliaris* (Retzius) Spring of the Selaginellaceae (Huang 1981a, pl. 7: 4-9).

16. SEMIRETISPORIS Reinhardt 1962 牛網紋孢屬

Type species: *Semiretisporis gothae* Reinh.
Diagnosis: "Trilete microspores; amb triangular to subtriangular; spore body covered by a thin skin that forms a flange at the equator; distally a coarse reticulum, the muri thin and high projecting radially." Rhaetic, Gotha, Thuringia.

(18) **Semiretisporis taiwanensis** *sp. nov.* 臺灣牛網紋孢

"Trilete spores; amb subtriangular, 76×70–75 μ; laesural arms extending to equator; exine ca. 2 μ thick, covered by a irregularly reticulate perine."
Locality: Chunlun Formation.
Slide: 127–1L (Pl. 7, Fig. 10–12).
Taxonomic affinity: Unknown.
Note: This palynomorph is possibly reworked from older sediments.

17. SKARBYSPORITES Van Erve 1977 環脊凸厚條孢屬

Type species: *Skarbysporites elsendoornii* Van Erve.
Diagnosis: "Trilete spores; amb triangular to subcircular; exine smooth or minutely ornamented; proximal surface distinct, well-developed kyrtomes are present; Y-mark almost extending to the equator."

(19) **Skarbysporites taiwanensis** *sp. nov.* 臺灣環脊凸厚條孢

"Trilete spores; amb subtriangular, with slightly concave sides and obtuse corners, 60×50–55 μ; laesural arms 25–28 μ long, with crassimarginate circumfluent laesural ridge (Kyrtome); equatorial ridge with margin tenuate at corner."
Locality: Liuchungchi Formation.
Slide: 15–1L (Pl. 8, Fig. 1–3, holotype), 97–1L.
Taxonomic affinity: Unknown.
Note: This species is similar to *S. puntii* Van Erve except the obtuse corners (Van Erve, A.V., 1977. pl. XII: 4–6).

18. SPHAERINA Maljavkina 1949 *ex* Delcourt & Sprumont 1959 突刺孢屬

Type species: *Sphaerina spinellate* Malj. 1953.
Diagnosis: "Spores round or oval in polar view; trilete rays as long as spore radius; spore covered with spines."

(20) **Sphaerina taiwanensis** *sp. nov.* 臺灣突刺孢

"Trilete spores; amb circular, 25–38 μ wide; Y-mark inconspicuous; exine ca. 1 μ thick, with enenly distributed echinate sculpture, the echini 2–4 μ long, 2–5 μ wide at base."
Locality: Liuchungchi Formation.
Slide: 9–1R (Pl. 2, Fig. 3, holotype), 68–1L, 75–2L.
Taxonomic affinity: Unknown.

19. SPHAGNUMSPORITES Raatz (1937) 1938 *ex* Potonié 1956 水苔孢屬

Type species: *Sphagnumsporites stereoides* (Pot. & Ven) Raatz.
Diagnosis: "Trilete microspores; amb convexly triangular; Y-mark 3/5–4/5 radius,

consisting of simple slits or flanked by narrow raised lips; exine proportionally thick and strong, smooth or with scabrate processes in surface view.

KEY TO THE SPECIES OF *Sphagnumsporites* 水苔孢屬

1. Exine less than 1 μ thick ..... *S. formosensis*
1. Exine more than 1 μ thick ..... *S. stereoides*

(21) **Sphagnumsporites formosensis** *sp. nov.* 寶島水苔孢

"Trilete spores; amb subtriangular, the sides straight or slightly convex, 26–32×24–28 μ; laesural arms extending to the equator. without torus; exine 0.5 μ thick; the lateral view psilate, hyaline-like or with scabrate sculpture."

Locality: Liuchungchi Formation.

Slide: 25–1L (Pl. 7, Fig. 5, holotype). 97–1R, 136–3R.

Taxonomic affinity: This species is similar to the extant species of *Sphagnum* of the Sphagnaceae (Boros & Járai-Komlódi, 1975, p. 86–99).

(22) **Sphagnumsporites stereoides** (Pot. & Ven) Raatz 立體狀水苔孢

"Trilete spores; amb convexly triangular to circular, 25–30×23–30 μ; laesural arms 8–12 μ long, with sinus laesural ridge; exine distinctly two-layered, the outer layer about half as thick as the inner one, 1.5 μ thick, the lateral view psilate or with scabrate sculpture, the surface view smooth."

Locality: Niaotsui Formation.

Slide: K4–1L, 112–2L (pl. 7, Fig. 3–4, holotype).

Taxonomic affinity: This species is similar to the extant species of *Sphagnum* of the Sphagnaceae (Boros, & Járai-Komlódi, 1975. p. 86–99).

20. TRIPLANOSPORITES: Pflug in Thomson & Pflug 1952 楊桃形三叉裂孢屬

(23) **Triplanosporites rugulatus** *sp. nov.* 散條紋楊桃形三叉裂孢

"Trilete spores; 45×38 μ; laesural arms indistinct; exine 1.5 μ thick, with scabrate processes in lateral view, the surface view rugulo-reticulate."

Locality: Yunshuichi Formation.

Slide: 53–1R (Pl. 8, Fig. 4–6).

Taxonomic affinity: Unknown.

Note: This species differs from *T. medius* by the rugulo—reticulate sculpture.

21. VERRUCINGULATISPORITES Kedves 1961a 牛圓紋蓋環三叉裂孢屬

KEY TO THE SPECIES OF *Verrucingulatisporites*

1. Elements baculate ..... *V. baculatus*
1. Elements granulate, tuberculate or verrucate
   2. Tubercula less than 3μ wide ..... *V. formosensis*
   2. Verrucae more than 4μ wide ..... *V. taiwanensis*

(24) **Verrucingulatisporites baculatus** *sp. nov.* 圓柱紋三叉裂孢

"Trilete spores; amb subtriangular, 40×35μ; laesural ridges with baculate processes, equatorial ridge with baculate elements, the elements 2–4μ long, 3–5μ wide, and evenly distributed."

Locality: Liuchungchi Formation.
Slide: 23-2L (Pl. 5, Fig. 6-7, holotype), 64-2R.
Taxonomic affinity: This species is similar to the extant species of *Onychium* of the Pteridaceae (Huang, 1981a pl. 66).
Note: This species is characterized by the regular baculate equatorial ridge.

(25) **Verrucingulatisporites formosensis** *sp. nov.* 寶島牟圓紋整環三叉裂孢

"Trilete spores; amb rounded triangular, the side straight, 42×46 μ; laesural arms 16-23 μ long; both laesural and equatorial ridges 5 μ wide, the surface view granulate and with tuberculate processes in lateral view."
Locality: Liuchungchi Formation.
Slide: 3-3L (Pl. 8, Fig. 7-8).
Taxonomic affinity: This species is related to the extant species of the Pteridaceae.
Note: This species differs from *V. taiwanensis* in larger size and smaller element.

22. VERRUCOPUNCTASPORITES Kar. Kieser & Jain 1973 牟圓紋鈍角孢

Type species: *Verrucopunctasporites globosus* Kar, K. & J.
Diagnosis: "Spores trilete, mostly subcircular, 42-90 μ, margin undulated due to projection of verrucae; trilete rays generally distinct, commissure well defined. Exine 1.5-4 μ thick, distally verrucae closely placed, 4-10 μ high."

(26) **Verrucopunctasporites taiwanensis** *sp. nov.* 臺灣牟圓紋鈍角孢

"Trilete perispores; amb subangular, 16-21×18-22 μ; trilete mark distinct, nearly extending to the equator; exine 0.5-1 μ thick, with coarse coniculate to verrucate sculpture, the elements 1-1.5 μ long, 3 μ wide at base."
Locality: Chunlun Formation.
Slide: 127-1L, 131-1L (Pl. 5, Fig. 9-10, holotype).
Taxonomic affinity: Unknown.

23. MONOGEMMITES Krutzsch 1970 錐刺單口孢粉屬

Type species: *Monogemmites gemmatus* (Coup.) Krtz.
Diagnosis: "Monosulcate to monosulcoid pollen like forms of ellipsoid, oval or almost spherical shape, covered with spini or echini."

(27) **Monogemmites formosensis** *sp. nov.* 寶島錐刺單口孢粉

"Monosuture perispore-like form, ovoid-subcircular in shape, 17-21×28-40×20-22 μ, the suture extend over 180° of the grain; exine 1-1.5 μ thick, with coniculate to echinate sculpture, the elements 2-3.5 μ long, 2×2.5 μ at base."
Locality: Niaotsui Formation.
Slide: 15-1L, 91-1R, 116-2L (Pl. 8, Fig. 9-11, holotype).
Taxonomic affinity: This palynomorph is probably a microplanktonic form.

(28) **Monogemmites taiwanensis** *sp. nov.* 臺灣錐刺單口孢粉

"Monolete spores, oval-circular in shape, 13-16×18-20×14 μ, the suture extend over semi-circular of the grain, forming lip-like margo in polar view; exine 0.5-1 μ thick, with echinate sculpture, the elements 1.5-2 μ long, 2 μ

wide at base."
Locality: Niaotsui Formation.
Slide: 75-1R, 118-1L, 121-2L (Pl. 8, Fig. 15, holotype).
Taxonomic affinity: This palynomorph is possibly a microplantonic form.

(ii) Gymnospermous pollen grains including four new species and one new record.

1. DACRYDIUMITES Cookson 1955 *ex* Harris 陸均松粉屬

(1) **Dacrydiumites magnus** *sp. nov.* 巨型陸均松粉

"Grains bisaccate; body transverselly elliptic, 95×50 μ; bladder 75×50 μ, with radial sculpture."
Locality: Niaotsui Formation.
Slide: 115-2L (Pl. 9, Fig. 1-2).
Taxonomic affinity: This species is related to species of *Podocarpus* of the Podocarpaceae.
Note: This new species differs from *D. taiwanensis* by its large size. This palynomorph is reworked from older sediments.

2. PODOCARPIDITES Cookson *ex* Couper 1953 羅漢松粉屬

KEY TO THE SPECIES OF *Podocarpites*

1. Cap more than 4 μ thick
   2. Body transverselly oblong-elliptic ..... *P. conjunctus*
   2. Body spheroidal ..... *P. magnus*
1. Cap less than 3 μ thick
   3. Bladders 3 ..... *P. trisaccatus*
   3. Bladders 2
      4. Body transverselly elongate, oblong-elliptic, the ratio between width and length of the body more than three times ..... *P. beugii*
      4. Body subspheroidal, the ratio between width and length of the body less than one and half times ..... *P. taiwanensis*

(2) **Podocarpidites conjunctus** *sp. nov.* 連結羅漢松粉

"Grains bisaccate; body transverselly oblong-elliptic, 33×70 μ; cap 4-6 μ, thick, with scabrate processes in lateral view, the surface view finely reticulate; bladders attached each other on cappula, 48×55 μ in polar view; sexine reticulate."
Locality: Liuchungchi Formation.
Slide: 25-1L (Pl. 9, Fig. 3-6).
Taxonomic affinity: This species is related to species of *Podocarpus* of the Podocarpaceae.
Note: This species differs from *P. taiwanensis* by its large size and thicker cap.

(3) **Podocarpidites magnus** *sp. nov.* 巨型羅漢松粉

"Grains bi- or trisaccate; body spheroidal, 60-80 μ wide, cap 7-10 μ thick, with scabrate processes in lateral view; bladders 70-80×30-35 μ, reticulate

in surface view."
Locality: Liuchungchi Formation.
Slide: 25-1L (Pl. 10, Fig. 3-5, holotype), 31-1R.
Taxonomic affinity: These palynomorphs perhaps belong to extinct taxa of Coniferales.
Note: These palynomorphs are possibly reworked from older sediments.

3. EPHEDRIPITES Bolkh. 1953 *ex* R. Pot. 1958 emend. Krutzsch 1961 麻黃粉屬

KEY TO THE SPECIES OF *Ephedripites*

1. Cross-grid pattern between grooves present
  2. Grains with more than 6 ridges
    3. Grains with 10-14 ridges ..... *E. multus*
    3. Grains with 7-10 ridges ..... *E. tertiarius*
  2. Grains with 6 ridges or 5 ridges
    4. Grains with 6 ridges, ellipsoidal, one pole obtuse, the other one acute ..... *E. kuanyinshanensis*
    4. Grains with 5 ridges, fusiform, one prominently prolate, other appendaged
      5. Grains large, more than 40×15 μ ..... *E. miocenus* var. *miocenus*
      5. Grains small, less than 33×14 μ ..... *E. miocenus* var. *minimus*
1. Cross grid-pattern between grooves absent
  6. Grain prolate, 30×19 μ ..... *E. ellipticus*
  6. Grain perprolate, 42-46×12-16 μ ..... *E. taiwanensis*

(4) **Ephedripites multus** *sp. nov.* 多肋麻黃粉

"Grains 12-14 ridges; perprolate, the poles obtuse; 46×28 μ, ridge 1 μ thick; the lateral view psilate, the surface view with cross-grid pattern (z-line)."
Locality: Yunshuichi Formation.
Slide: 79-2L (Pl. 10, Fig. 1-2).
Taxonomic affinity: Possibly this species belongs to a member of the *Ephedra* of the Ephedraceae.

(5) **Ephedripites tertiarius** Krutzsch 第三紀麻黃粉

"Grains 6-10 ridged; perprolate; 50-57×25-30 μ; ridges 1-1.5 μ wide; lateral view psilate, the surface view with cross-grid pattern (z-line)."
Locality: Kanhsialiao Formation.
Slide: K4-1R, 118-1R.
Taxonomic affinity: This species is a member of the *Ephedra* of the Ephedraceae.

(iii) Angiospermous pollen grains including five genera, 23 new species, two new records and one new combination.

1. TRACHELOSPERMUMPOLLENITES *gen. nov.* 絡石粉屬

Type species: *Trachelospermumpollenites taiwanensis* Huang & Huang.
Diagnosis: "Grains polyporate; pores crassimarginate; exine thin, ca. 0.5 μ, thick, psilate or with scabrate processes."

(1) **Trachelospermumpollenites taiwanensis** *sp. nov.* 臺灣絡石粉

"Grains polyporate, prolate, 26–30×15–17 μ; pores crassimarginate, 3.5 μ wide including annulus; exine 0.5 μ thick, psilate or with scabrate processes in lateral view, the surface view smooth."
Locality: Chunlun Formation.
Slide: 129-1L (Pl. 10, Fig. 6–8, holotype), 144-1R.
Taxonomic affinity: This species is similar to extant species of *Trachelospermum gracilipes* Hook, f. of the Apocynaceae (Huang 1972, p. 60).
Note: This genus is simalar to *Parsonidites* Couper 1960, but *Parsonidites* is a pending taxon (Muller, 1981).

2. ILEXPOLLENITES Thiergart 1937 *ex* Potonié 1960 冬青粉屬

(2) **Ilexpollenites minor** *sp. nov.* 小型冬青粉

"Grains prolate, 15–16×12–14 μ, the lateral view clavate, the clavae 1 μ long, 1 μ wide; exine 1 μ thick, the surface view granulate, with LO-pattern."
Locality: Liuchungchi Formation.
Slide: 39-1L (Pl. 10, Fig. 11–12, holotype), 115-2R.
Taxonomic affinity: This species is similar to the extant species of *Ilex* of the Aquifoliaceae.
Note: This species differs from *I. asprella* and *I. kusanoi* by smaller size.

3. ARTEMISIAEPOLLENITES Nagy 1969 茵陳蒿粉屬

Type species: *Artemisiaepollenites sellularis* Nagy.
Diagnosis: "Small tricolporate pollen with small spines on the tegillum; interbaculate with reticulate surface." Miocene, Hungary.

(3) **Artemisiaepollenites annus** *sp. nov.* 茵陳蒿粉

"Grains 3-colporate; amb circular, 18 μ wide; exine 3.5 μ thick, tectum ca. 2 μ thick, reticulate in surface view."
Locality: Niaotsui Formation.
Slide: 112-2L (Pl. 10, Fig. 14–15).
Taxonomic affinity: This species is very similar to *A. annus* L. of the Compositae (Huang 1972, pl. 42: 13–14).

4. HEMISTEPTAPOLLENITES *gen. nov.* 泥胡菜粉屬

Type species: *Hemisteptapollenites hyratus* Huang & Huang.
Diagnosis: "Grains 3-colporate; exine with blunt echinate processes."

(4) **Hemisteptapollenites hyratus** *sp. nov.* 泥胡菜粉

"Grains 3-colporate; spheroidal, 28–30 μ wide; exine 2–5 μ thick, with echinate processes, the echini blunt, 1.5×2 μ in size."
Locality: Niaotsui Formation.
Slide: 123-2L (Pl. 11, Fig. 1).
Taxonomic affinity: This species is similar to the extant *Hemistepta hyrata* Bunge. (Huang 1972, pl. 46: 12–13).
Note: This genus differs from *Ageratumpollenites* by the blunt echini.

5. CICHOREACIDITES Sah 1967 高苣粉屬

Type species: *Cichoreacidites spinosus* Sah.
Diagnosis: "Grains fenestrate, with composite aperture; exine echino-lophate."

(5) **Cichoreacidites taiwanensis** *sp. nov.* 臺灣高苣粉

"Grains fenestrate, 21–26 μ wide; exine 3 μ thick, with echino-lophate processes, the lacuna 4×6 μ, the echini 2×2.5 μ."
Locality: Yunshuichi Formation.
Slide: 68–1L (Pl. 11, Fig. 2–3, holotype), 106–1L.
Taxonomic affinity: This species is similar to the extant species of Liguliflorae of the Compositae.
Note: Van der Hammen had named the same palynomorph as *Fenestrites* in 1965, however, it was illegitimate due to the contaminated type specimen, which was a recent pollen grain (Jansonius & Hills, 1976).

6. TRICOLPOPOLLENITES Pflug & Thomson in Thomson & Pflug 1953 非菜粉屬

(6) **Tricolpopollenites morrisonensis** *sp. nov.* 玉山非菜粉

"Grains tricolpate, prolate-spheroidal, 18–23×15–21 μ; exine 1–1.5 μ thick, the lateral view with scabrate processes, reticulate in surface view, the lumina ca. 0.7 μ wide."
Locality: Niaotsui Formation.
Slide: 3–1L, 75–2L, 120–1L (Pl. 10, Fig. 16–17, holotype).
Taxonomic affinity: This species is similar to the extant *Arabis morrisonensis* Hay. of the Cruciferae (Huang 1972, pl. 54: 26–30).

7. SLOWAKIPOLLIS Krutzsch 胡頹子粉屬

Type species: *Slowakipollis cechovici* (Pacl.) Krtz.
Diagnosis: "Tricolporate pollen; amb triangular, or square, germinals with complex "pentapollenoid" structure, usually with only a short exocolpus, the lateral view with psilate or with weak structure."

(7) **Slowakipollis taiwanensis** (T.C. Huang, 1980) C.L. Huang & T.C. Huang *comb. nov.* 臺灣胡頹子粉

Synonym: *Elaeagnuspollenites taiwanensis* Huang in Taiwania **25**: 78, pl. 9: 5–8.
"Ticolporate pollen; amb semi-angular to subtriangular or square, 30–40 μ wide; pores atrium type, the surface view with granulate sculpture."
The same palynomorphs were also found in Kanhsialiao, Niaotsui, Yunshuichi and Chunlun Formation.
Note: Such *Elaeagnus* type palynomorph has also been described by Ke & Shi (1978) (Jansonius & Hills, 1979) as *Elaeangnacites*. According to I.C.B.N. the type species of *Elaeangnacites* should be transferred to the new combination as *Slowakipollis huanghuaensis* (Ke & Shi) C.L. Huang & T.C. Huang *comb. nov.*

8. WILSONIPITES Srivastava 1969 蓖麻粉屬

Type species: *Wilsonipites nevisensis* Sriv.
Diagnosis: "Tricolporate; amb subtriangular to circular, the sides convex: colpi long, to reaching poles; pores small, inconspicuous; sexine very thin, the lateral view scabrate, the surface view reticulation, the mesh less than 1 μ."

(8) **Wilsonipites communius** *sp. nov.* 蓖麻粉

"Grains 3-colporate; amb circular; colpi long, nearly reaching to poles; pore small; exine 1 μ thick, the lateral view psilate, the surface view granulate."
Locality: Yunshuichi Formation.
Slide: 74-2R (Pl. 11, Fig. 7-8, holotype), 64-1L, 115-2R.
Taxonomic affinity: This species is similar to the extant *Riccinus communis* L. of the Euphorbiaceae (Huang 1972, pl. 69: 32-33).

9. CARYAPOLLENITES Raatz (1973) *ex* Potonié 1960 山核桃粉屬

Type species: *Caryapollenites simplex* Raatz.
Diagnosis: "3-porate; spheroidal to subtriangular; pores circular, arranged subequatorially."

(9) **Caryapollenites taiwanensis** *sp. nov.* 臺灣山核桃粉

"Grains 3-porate; amb subtriangular to circular, 27-45 μ wide; pores circular, arranged subequatorially; exine 1-1.5 μ thick, psilate in lateral view, the surface view granulate."
Locality: Yunshuichi Formation.
Slide: 15-2L (Pl. 11, Fig. 16, holotype), 85-1L.
Taxonomic affinity: This species is similar to extant species of *Carya* of the Juglandaceae.

10. ENGELHARDTIOIPOLLENITES Potonié 1951 *ex* Potonié 1960 黃杞粉屬

Type species: *Engelhardtioipollenites punctatus* (Pot.) Pot.
Diagnosis: "3-porate; amb rounded triangular; pores without annulus."

(10) **Engelhardtioipollenites taiwanensis** *sp. nov.* 臺灣黃杞粉

"Grains triporate; amb rounded triangular, 11-12 μ wide; pores at the corners, without annulus; exine 0.5 μ thick, psilate in lateral view."
Locality: Niaotsui Formation.
Slide: 112-1R (Pl. 11, Fig. 12-13, holotype), 116-2R.
Taxonomic affinity: This species is similar to the extant *Engelhardtia roxburghiana* Wall. of the Juglandaceae (Huang 1972, pl. 78: 11-13).

11. PARAPHLOMIPOLLENITES *gen. nov.* 錘子草粉屬

Type species: *Paraphlomipollenites taiwanensis* Huang & Huang.
Diagnosis: "Grains 3-colpate; amb open circular, the lateral view reticulate, with mesh 0.5-1 μ across."

(11) **Paraphlomipollenites taiwanensis** *sp. nov.* 臺灣舞子草粉

"Grains 3-colpate; amb open circular, 36–40 μ wide; exine 1 μ thick, with verrucate processes, the surface view reticulate, the mesh ca. 0.7 μ across."
Locality: Niaotsui Formation.
Slide: 101–1L (Pl. 13, Fig. 5–6).
Taxonomic affinity: This species is similar to the extant species of *Paraphlomis* of the Labiatae (Huang 1972, p. 131).

12. RETIHEXACOLPITES Mathur 1966 鼠尾草粉屬

Type species: *Retihexacolpites brevicolpatus* Math.
Diagnosis: "Reticulate hexacolpate sporomorphs."

(12) **Retihexacolpites taiwanensis** *sp. nov.* 臺灣鼠尾草粉

"Grains 6-colpate, prolate, 42×33 μ; exine 1.5 μ thick, the surface view reticulate, the muri ca. 1 μ wide."
Locality: Niaotsui Formation.
Slide: 35–1L, 120–1L (Pl. 12, Fig. 1–3, holotype).
Taxonomic affinity: This species is similar to the extant species of *Salvia* of the Labiatae (Huang 1972, pl. 80–81).

13. ASSAMIALETES R. Y. Singh 1975 灰莉粉屬

Type species: *Assamialetes emendatus* (Sah. & Dutta) R. Y. Singh.
Diagnosis: "Pollen grains circular to subcircular in outline, nonaperture; exine ornamented with perfect reticulum on both surfaces; lumina of the reticulum fairly large, rounded to polygonal; equatorial outline wavy."

(13) **Assamialetes taiwanensis** *sp. nov.* 臺灣灰莉粉

"Grains inaperturate, subspheroidal, 40–45 μ wide; exine 3–4 μ thick; tectum with verrucate processes, the surface view coarsely reticulate, the lumina very large, 5–8 μ wide, muri 2 μ wide."
Locality: Chunlun Formation.
Slide: 125–2L (Pl. 12, Fig. 4–6).
Taxonomic affinity: This species is similar to the extant *Fagraea sasakii* Hay. of the Loganiaceae (Huang 1972, pl. 99: 13–20).

14. MALVACEARUMPOLLIS Nagy 1962 錦葵粉屬

Type species: *Malvacearumpollis bakonyensis* Nagy.
Diagnosis: "Large (85–105 μ) globular pollen grains, psilate and covered with conical spines in fairly regular, rising on a bulging base formed by the exine." L. Helvetian, Hungary.

(14) **Malvacearumpollis taiwanensis** *sp. nov.* 臺灣錦葵粉

"Grains pantoporate, 65–75 μ wide; exine 3–6 μ thick; tectum with echinate processes, the echini 5–6 μ long."
Locality: Niaotsui Formation.
Slide: 116–2L (Pl. 12, Fig. 12–14).

Taxonomic affinity: This species is similar to the extant species of *Abutilon* of the Malvaceae (Huang 1972, pl. 103: 2-7).

15. MYRTACEIDITES Cookson & Pike 1954 桃金孃粉屬

Type species: *Myrtaceidites mesonesus* Cooks. & Pike.
Diagnosis: "Tricolporate pollen, angulaperturate; arcus distinct, the surface view smooth or granulate."

(15) **Myrtaceidites taiwanensis** *sp. nov.* 臺灣桃金孃粉

"Grains 3-4 syncolporate; amb triangular-subtriangular, with straight or slightly convex sides, 12-15 μ wide; exine ca. 0.5 μ thick, psilate in lateral view, the surface view granulate."
Locality: Yunshuichi Formation.
Slide: 11-1R, 81-2L (Pl. 12, Fig. 10, holotype), 112-1R.
Taxonomic affinity: This species is similar to the extant species of Myrtaceae (Huang 1972, pl. 109-110).

16. SPOROTRAPOIDITES Kiaus 1954 擬菱角粉屬

Type species: *Sporotrapoidites illingensis* Kl.
Diagnosis: "Prolate to suboblate; amb triangular to round, with three exinal ridges traverse the body, meeting at angles of 120° at the pores; on the equator, three short, narrow meridional apertures, each are enclosed by one exinal ridges, similar to pollen of recent *Trapa* species." U. Miocene, Austria.

(16) **Sporotrapoidites illingensis** Kl. 依林擬菱角粉

"Grains 3-colpate?, prolate, 55-86 μ wide (including exinal ridges); exine 5 μ thick, with three exinal ridges meeting at the poles, the ridges ca. 15 μ wide; irregularly reticulate in surface view."
Locality: Liuchungchi Formation.
Slide: 25-1L (Pl. 13, Fig. 1-3).
Taxonomic affinity: Possibly this palynomorph is related to the extant species of *Trapa* of the Onagraceae (Huang 1972, pl. 77: 4-9).

17. PLANTAGINACEARUMPOLLIS Nagy 1963c 車前草粉屬

Type species: *Plantaginacearumpollis miocenicus* Nagy.
Diagnosis: "Spheroidal pollen grains with 4-5 rather equally arranged pores, the lateral view psilate to scabrate, the surface view granulate."

(17) **Plantaginacearumpollis formosensis** *sp. nov.* 寶島車前草粉

"Grains 4-5 porate, spheroidal, 17-20 μ wide; aperture common type; exine 1 μ thick, psilate in lateral view, granulate in the surface view."
Locality: Liuchungchi Formation
Slide: 42-3L (Pl. 13, Fig. 7-8, holotype), 83-1L, 106-1L, 125-2L.
Taxonomic affinity: This species is similar to the extant *Plantago formosana* of the Plantaginaceae (Huang 1972, pl. 116: 15-16).

18. MARGOAPERTURATES *gen. nov.* 厚口緣粉屬

Type species: *Margoaperturates taiwanensis* Huang & Huang.
Diagnosis: "Grains 3-colporate; aperture crassimarginate, the surface view finely reticulate."

(18) **Margoaperturates hypoleucus** *sp. nov.* 裏白厚口緣粉

"Grains 3-colporate; amb inter-semi-lobate, 17–26 μ wide; aperture slightly crassimarginate; exine 0.5–1 μ thick, with scabrate processes in lateral view, the surface view finely reticulate."
Locality: Yunshuichi Formation.
Slide: 75–1R (Pl. 13, Fig. 14–15, holotype), 123–1L, 127–2L.
Taxonomic affinity: This species is similar to the extant *Polygonum hypoleucum* Ohwi.

(19) **Margoaperturates taiwanensis** *sp. nov.* 臺灣蛇根草粉

"Grains tricolporate, subprolate to prolate-spheroidal, 25–32×21–30 μ; aperture crassimarginate; exine ca. 1.5 μ thick, with scabrate processes in lateral view, the surface view finely reticulate, the lumina less than 0.5 μ across."
Locality: Yunshuichi Formation.
Slide: 68–1L, 83–1L (Pl. 13, Fig. 10–11, holotype), 112–2L.
Taxonomic affinity: This species is similar to the extant species of *Ophiorhiza* of the Rubiaceae (Huang 1972, pl. 134: 8–12).

19. RUTACEOIPOLLENITES Sun 1978 芸香粉屬

Type species: *Rutaceoipollenites zekouensis* Ma. 1978.
Diagnosis: "Grains tricolporate, prolate to nearly spheroidal: colpi narrow, with pores that cross the colpi; exine essentially smooth or finely reticulate."

(20) **Rutaceoipollenites taiwanensis** *sp. nov.* 臺灣芸香粉

"Grains 3-colporate, 21–35 μ wide; exine 1 μ thick, the lateral view psilate, the surface view smooth."
Locality: Yunshuichi Formation.
Slide: 79–2L (Pl. 14, Fig. 1–2).
Taxonomic affinity: This species resemble to the extant *Murraya paniculatus* (L.) Jack. of the Rutaceae (Huang 1972, pl. 136: 35–38).

20. TRICOLPOROPOLLENITES Pflug & Thomson in Thomson & Pflug 1953 繡球粉屬

(21) **Tricolporopollenites asper** *sp. nov.* 繡球粉

"Grains tricolporate; polate to subprolate, 14–18×11–14 μ; exine 0.5–1 μ thick, the surface view finely reticulate, with OL-pattern, the mesh 0.5 μ wide, with scabrate processes in lateral view."
Locality: Chunlun Formation.
Slide: 68–1L, 101–1L, 131–1L (Pl. 14, Fig. 3–4, holotype).

Taxonomic affinity: This species is similar to the extant *Hydrangea aspera* D. Don. of the Hydrangenaceae (Huang 1972, pl. 140: 40-42).

21. PATRINIAPOLLENITES *gen. nov.* 敗醬粉屬

Type species: *Patriniapollenites taiwanensis* Huang & Huang.
Diagnosis: Grains 3-colpate; exine ca. 2.5 μ thick, with echinate processes."

(22) **Patriniapollenites taiwanensis** *sp. nov.* 臺灣敗醬粉

"Grains 3-colpate; amb circular, 45-48 μ wide; exine 2-3 μ thick, with echinate processes in lateral view, the surface view granulate."
Locality: Yunshuichi Formation.
Slide: 64-2L (Pl. 14, Fig. 7-10).
Taxonomic affinity: This species is similar to the extant *Patrinia scabiosaefolia* Fisch. of the Valerianaceae (Huang 1972, pl. 159: 7).

22. COUPERIPOLLIS Venkatachala & Kar 1969 刺棕粉屬

Type species: *Couperipollis perspinosus* (Coup.) Venk. & Kar.
Diagnosis: "Monosulcate pollen grain; oval-circular; sulcus well-developed, the lateral view baculate, echinate or verrucate." Pliocene, New Zealand.

(23) **Couperipollis taiwanensis** *sp. nov.* 臺灣刺棕粉

"Grains monosulcate; 20-32×12-15 μ; exine 1 μ thick, with echinate processes in lateral view, the echini 1-2.5 μ long, the surface view granulate."
Locality: Niaotsui Formation.
Slide: 105-1R (Pl. 14, Fig. 13-14, holotype), 116-1L, 120-1L.
Taxonomic affinity: This species is resemble to the extant species of *Arenga* of the Palmae (Huang 1972, pl. 176: 7-9).

23. SPARGANIACEAEPOLLENITES Thiergart 1937 黑三稜粉屬

Type species: *Sparganiaceaepollenites polygonalis* Thierg.
Diagnosis: "Spheroidal pollen, finely infrareticulate, with one pore."

(24) **Sparganiaceaepollenites taiwanensis** *sp. nov.* 臺灣黑三稜粉

"Grains monoporate, spheroidal to subspheroidal, 22-26 μ wide; exine 1 μ thick, the lateral view psilate, the surface view finely reticulate."
Locality: Liuchungchi Formation.
Slide: 3-1L (Pl. 14, Fig. 17-18, holotype), 142-2L.
Taxonomic affinity: This species is related to the extant Sparganiaceae, Typhaceae or Flagellariaceae.

24. NEOTRIANGULIPOLLIS Goczan, Groot & Krutzsch in Goczan, Groot, Krutzsch & Pacltova 1967 新三角粉屬

Type species: *Neotriangulipollis piolencensis* Groot & Krtz.
Diagnosis: "Grains 3-porate; amb weakly convexly triangular; pores at the corners,

with labrum and/or a weak annulus, with a narrow vestibulum between exo- and endo-pore, no oculi, arci, plicae, etc.; exine more than one layer, distinctly finely sculptured." Santonian, France.

(25) **Neotriangulipollis taiwanensis** *sp. nov.* 臺灣新三角粉

"Grains 3-porate; amb triangular, with slightly convex sides, 20×19 μ; exine distinctly 3-layered, 2 μ thick, with psilate to scabrate sculpture in lateral view; the pores not protruding in the equatorial outline; praevestibulum wider than postvestibulum; endpore, mesopore and exopore about the same wide, ca. 0.5 μ wide."

Locality: Niaotsui Formation.
Slide: 105-1L (Pl. 14, Fig. 21-23).
Taxonomic affinity: This species belongs to the Normapollis.
Note: This palynomorph is possibly reworked from older sediments.

25. RIESTEDTIPOLLIS Krutzsch 1969 雷斯太德粉屬

Type species: *Riestedtipollis polycolpites* Krtz.
Diagnosis: "Flat-lenticular, with 3-6, usually 4-5 equatorial germinals placed in the corners; amb triangular to hexagonal, with more or less straight sides; exine smooth. "M. Paleocene-L. Eocene, Germany.

(26) **Riestedtipollis polycolpites** Krtz. 雷斯太德粉

"Grains tetraporate; amb rectangular, with straight side; pores at the corners; exine ca. 0.7 μ thick, smooth in surface view."

Locality: Niaotsui Formation.
Slide: 106-1L (Pl. 14, Fig. 19-20).
Taxonomic affinity: This species is a member of the Normapollis.
Note: This palynomorph is possibly reworked from older sediments.

(2) Pollen Zone

Seven pollen zones are determined on the basis of natural assemblages of pollen type; therefore, they are also called pollen assemblage zones (Hedberg, 1976).

Zone I: The lower part of Chunlun Formation.

Zone I is characterized by the low frequencies (less than 1.5%) of *Alnus*, *Pterocarya* and Gramineae pollen. Frequency values of *Abies-Picea* pollen percentages show a marked drop at the top of this zone, while the frequencies of TCT (Taxodiaceae-Cupressaceae-Taxaceae) pollen rise sharply.

Zone II: The upper part of Chunlun Formation and the bottom of Niaotsui Formation

This zone is defined by the low values of *Abies-Picea* pollen frequencies together with the decline of TCT pollen percentage and the increase of *Polygonum* pollen frequencies toward the top of this zone. The spores of *Anthoceros* type first occurred at the top of Zone II.

Zone III: The lower part of Niaotsui Formation.

Zone III is characterized by the occurrence of *Alnus* pollen at a constant value of 3%. There is a marked peak of *Abies-Picea* pollen frequencies in the lower part of this zone. Frequencies of Fagaceae pollen decline in the beginning, then rise to the top of this zone.

Zone IV: The upper part of Niaotsui Formation.

This zone is characterized by the continuous curves of both TCT and *Alnus* pollen, the former shows a slight decline and the latter a steady increase toward the top of this zone. Frequencies of Fagaceae pollen fall sharply at the top of this zone.

Zone V: The entire Yunshuichi Formation.

Zone V is defined by the two sharp rises of *Ceratopteris-Lygodium* spore frequencies at the beginning and the upper part of this zone. Spores of *Corrusporis* occur at the beginning of this zone, then disappear up to the next two zones.

Zone VI: The lower part of Liuchungchi Formation.

This zone is characterized by the marked peak in TCT and Gramineae pollen frequencies and coincides with the decline of pteridophytous spore frequencies. Frequencies of *Alnus* pollen and triporate pollen have marked peaks at the upper part of this Zone.

Zone VII: The upper part of Liuchungchi Formation and the lower part of Kanshialiao Formation.

Zone VII is marked by the opposing changes that occur between the frequencies of the elements of Subalpine-Temperate and Subtropical-Tropical assemblages. From the lower part of this zone, the frequencies of elements of Subalpine-Temperate assemblage decline, rise sharply and decline again, then rise sharply at the top of this zone, but the frequencies of elements of Subtropical-Tropical assemblage show contradictory changes.

DISCUSSION

The fossil spore genera of *Schizaeoisporites*, *Cicatricosisporites* and *Magnastriatites*, which bear the characteristics of large size and the striate ornamentation, are very commonly found in the Tertiary sediments. This spore type is similar to the extant taxa of *Ceratopteris* and *Anemia*, which are distributed in the tropical and subtropical regions (Bolknovitina, 1961; Huang, 1981a; Kremp & Kawasaki 1972). Some of the spore types mentioned above have reticulate ornamentation on the proximal face (pl. 4, fig. 2; pl. 17, fig. 1; pl. 20, figs. 1-2, 9-10). After we examined the spores of *Ceratopteris* and *Anemia* extracted from the specimens of TAI-herbarium, no spore with reticulate ornamentation on the proximal face was found, and all of them belong to the smooth pattern. Therefore, the smooth exine pattern might have evolved from the reticulate pattern. When the reticulate pattern on the proximal face disappeared and became the advanced smooth type should be further investigated.

Compared the palynomorphs with that of the Miocene of Taiwan (Chaw, 1980; Huang, 1980b; Shaw & Huang, 1983), we found that there is only a small difference between the composition of the Pliocene and Miocene fossil pollen flora of Taiwan. If we compare the study of fossil angiospermous taxa of Taiwan with Muller's work (Muller, 1970, 1981), the new taxa found in the upper Miocene and lower Pliocene of Taiwan are correspond to the records in other areas (Table 3). According to Muller's work, the fossil pollen record of Loganiaceae and Valerianaceae has not yet been sufficiently documented. In this study, however, the *Patrinia* pollen type was found in sample 64, and the *Fagraea* pollen type in sample 125; both are very similar to the extant pollen of those two genera respectively.

Analysis of the pollen diagram from sediments of tropical and subtropical areas is usually more difficult than in the temperate area, due to the complex flora (194 taxa in this study) and the less prominent glaciation effect. Although some taxa with a few grains alternately occured and disappeared, they are considered to be either reworked or short distance dispersed forms. Such taxa are thought to have local significance, but are not important in stratigraphical correlations.

As pollen analysis is still a very young science in Taiwan, there are few references available for consultation. Given this condition, the pollen diagram in this study is modified from Bennet (1983). In grouping the pollen types and dividing the pollen zone, the euryoecious taxa, such as the species of *Pinus*, and many pteridophytous species of artificial form genera are rarely used as indicators. *Podocarpus* and *Ceratopteris-Lygodium* show similar pollen percentage changes (Fig. 3), but some show opposed changes such as that which occurs between TCT pollen and the sum of pteridophytous spores. In Zone VII, the elements of Subalpine and Temperate, of Subtropical and Tropical show parallel changes, but between the two climatic groups they display opposed changes.

The antagonistic changes between the two climatically meaningful groups imply that the climate dominates the vegetation, and that the vegetation succession can be partially recorded by the pollen data via the stratified nature of the evidence. Therefore, the climate and vegetation succession can be traced from the pollen line (Faegri, Iversen & Waterbolk, 1966), of the important taxa.

Though some taxa, such as the members of Lauraceae, which are usually rich in flora, cannot be revealed from the pollen diagram, however we can recognize some forest types based on knowledge of the present vegetation (Huang & Huang, 1983). From the diagram, we can see that no drastic change occurs in the vegetation from the upper Miocene through the Pliocene to the lower Pleistocene. The dominant taxa are the members of Fagaceae, *Betula*, *Alnus*, *Pterocarya*, Taxodiaceae-Cupressaceae-Taxaceae and mostly perine lost monolete spores. Like the present vegetation of Taiwan, the warm-temperate forest occupied by Lauro-Fagaceae is also prevailed in the past. The high frequencies of Fagaceae pollen accompanied with the verrucate and gemmate monolete spores, which were produced by the epiphytic fern species of Polypodiaceae and Davalliaceae, are the characteristic features of this forest type (Huang & Huang, 1983). The lowland vegetation may be either *Ceratopteris* and *Typha* in the paddy fields or shallow fresh water ponds, or *Polygonum*, *Chenopodium* and Gramineae on the seashore or open field. The tropical and subtropical rain forests that contained *Lygodium*, *Elaeocarpus*, *Podocarpus* and *Dacrydium* may also occur. The cool-temperate forest including *Ulmus*,

Betula, Zelkova, Liquidamber, Carpinus and *Juglans*, joined with the subalpine coniferous forest composed of *Abies, Picea* and *Tsuga* which may occupy the high mountain area. Some of the fossil taxa, *Tilia, Pterocarya, Carya, Dacrydium*, and *Ephedra*, no longer exist in the flora of Taiwan, but are elements of the modern vegetation of southeastern mainland China (Academia Sinica, 1972).

The climate condition in Zone II was evidently warm, since there are low frequencies of the boreal taxa such as *Abies* and *Picea*. In the beginnig of Zone V, the frequencies of *Ceratopteris* and *Podocarpus* increased sharply, then zigzagged, and once again, a peak markedly in the upper part of this zone. The *Ceratopteris* and *Podocarpus* are both members of tropical vegetation type; therefore, Zone V might have had a warm climate, especially in the beginning and upper part. In Zone VI, dry and cool temperatures may have prevailed. Since the increase in the frequencies of TCT and Gramineae pollen, which indicate cool, dry conditions, coincides with the decrease of the frequencies of the sum of pteridophytous spores, a decrement in temperature and humidity is implied. The frequencies of elements of the Subalpine-Temperate and Subtropical-Tropical show antagonistic changes from the beginning of Zone VII, indicating the alternation of cold and warm climatic changes throughout this zone. Thus the vegetation may have been influenced by alpine glacial and Zone VII may belong to the early stage of the Pleistocene. Additionally, the P/P boundary (Pliocene/Pleistocene boundary) may be located in the middle of the Liuchungchi Formation.

The reworked palynomorphs such as *Appendicisporites, Concavisporites, Skarbysporites, Classopollis, Notriangulipollis, Riestedtipollis* and *Dinogymnium* are found in many samples. Some of them appeared only in a short period of geological time, such as the Normapolles that occured abundantly in the Cretaceous and Early Tertiary sediment (Penny, 1969), while others (*Dinogynium*, etc.) not only indicate the Cretaceous time but also imply a marine sedimentary environment (Evitt, 1969). Based on these reworked palynomorphs, the presence of outcrops of Cretaceous marine deposits in the sedimentary cycle of Yunshuichi section can be reasonably inferred.

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Table 1. Number and percentage

Taxa	K6	K4	K2	K1	1	3	9	11	15
Tricolporopollenites amygdalifolius	4.7	6.7	14.6	19.3	14.2	10.6	8.2	6.8	9.7
T. uraiensis	2.5	5.5	9.2	7.0	7.7	3.2	6.4	5.4	4.6
T. minus	2.0	1.8	2.7	4.1	2.2	0.5	1.6	3.4	2.5
T. scabratus	0.0	0.2	0.7	0.0	1.3	0.0	1.8	1.4	1.5
T. perprolatus	0.6	0.0	0.4	0.0	1.3	0.8	0.0	0.0	0.0
Alnipollenites formosensis	1.7	4.8	10.5	8.2	7.5	2.6	6.6	8.2	5.6
Alnusalispollenites taiwanensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Polyatriopollenites taiwanensis	1.1	3.7	1.7	1.6	2.9	1.3	2.5	2.8	1.8
Triwestibulopollenites taiwanensis	11.5	6.0	2.6	3.3	4.2	6.6	2.0	1.4	1.5
Triporopollenites coryloides	2.2	0.2	0.4	0.8	1.1	3.2	0.2	0.3	1.0
Myricaceoipollenites megagranifer	0.0	2.3	2.0	0.8	0.2	0.0	0.2	0.8	2.5
Tiliaepollenites taiwanensis	0.3	0.2	0.2	0.0	0.2	0.5	0.0	0.0	0.3
Carpinipites taiwanensis	0.0	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0
Caryapollenites taiwanensis	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.3	0.5
Peripollenites formosensis	5.3	4.4	2.0	2.5	4.9	2.1	3.4	1.4	3.1
P. minus	4.2	1.4	0.0	0.0	0.7	2.1	0.0	0.8	1.0
Elaeocarpollenites taiwanensis	0.6	0.7	1.1	0.8	0.9	1.3	3.0	2.3	2.3
Triatriopollenites taiwanensis	1.1	0.2	0.4	0.8	0.7	0.0	0.2	0.8	0.3
Daphniphyllumpollenits oldhamii	0.3	0.0	0.4	0.0	0.9	0.0	1.1	0.8	0.5
Tricolporopollenites taiwanensis	0.0	0.0	0.0	0.0	0.2	0.3	0.2	0.3	0.0
Wilsonipites communis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Myrtaceidites taiwanensis	0.0	0.0	0.0	0.4	0.7	0.0	0.2	0.3	0.0
Magnolipollis taiwanensis	0.8	0.0	0.0	0.0	0.0	1.8	0.0	1.4	2.0
M. medius	0.0	0.5	0.0	0.0	0.0	0.5	0.0	0.6	0.0
M. longiformis	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
Ulmipollenites taiwanensis	2.0	1.4	0.2	0.8	0.7	1.8	0.5	0.0	0.5
Zelkovaepollenites taiwanensis	1.1	0.7	0.4	0.4	0.0	1.1	0.0	0.0	0.8
Juglanspollenites taiwanensis	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ilexpollenites asprella	0.6	0.5	0.7	1.6	0.2	0.5	1.1	0.0	0.8
I. kusanoi	0.0	0.2	0.2	0.0	0.0	0.5	0.0	0.0	0.5
I. minor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Symplocacites modesta	0.0	0.5	0.4	0.0	0.7	0.0	0.0	0.0	0.0
S. caudata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Engelhardtioipollenites taiwanensis	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Graminidites glabratus	1.7	1.6	1.3	0.8	2.4	0.3	3.2	0.3	1.3
Polyonacidites densoreticulatus	0.0	0.0	0.7	0.0	0.2	0.0	0.0	0.0	0.5
P. vulgaris	0.0	1.6	0.7	1.4	0.4	1.6	0.7	0.3	0.3
P. minus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Margoaperturates hypoleucus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pericampyluspollenites taiwanensis	1.7	0.5	0.2	0.0	0.0	1.8	0.2	0.0	0.0
Plantaginacearumpollis formosensis	0.0	0.0	0.4	0.0	0.0	0.3	0.0	0.8	0.8
Chenopodiopollis taiwanensis	0.3	0.2	0.4	0.0	0.4	0.0	0.0	0.8	0.3

of palynomorphs (1st section)

Sample number															
21	23	25	31	35	39	42	47	49	53	64	68	69	71	74	75
9.3	9.6	6.0	6.3	6.7	3.3	8.6	6.2	10.3	4.2	4.7	8.5	5.3	6.2	3.8	13.1
3.3	3.3	5.8	3.3	3.9	4.9	1.5	2.4	1.6	2.5	0.7	2.8	2.8	4.2	2.9	4.0
3.3	2.1	2.7	3.3	2.8	1.4	2.3	1.8	4.8	2.2	1.5	3.0	1.9	1.0	0.4	2.7
1.4	1.6	1.6	0.9	1.7	0.0	1.0	0.0	0.0	0.7	1.2	0.0	0.0	0.0	0.4	1.6
0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.9	0.0	0.0	0.0	0.4	0.0	0.5	0.0	0.2
10.7	8.4	7.6	7.0	6.7	8.2	8.1	5.6	5.8	6.5	7.2	7.3	15.2	9.6	11.7	9.8
0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
3.3	2.8	3.8	5.6	4.5	3.8	4.6	7.3	3.5	3.1	6.7	7.9	8.0	5.5	4.2	4.7
4.9	2.3	3.8	5.1	5.6	3.8	1.5	3.6	2.9	2.5	3.0	4.5	1.2	4.4	2.7	3.6
0.0	1.4	1.1	0.5	0.3	0.3	0.3	0.4	0.0	0.0	0.2	0.4	0.3	0.3	0.2	0.2
0.3	1.6	1.1	2.8	0.0	0.5	1.5	1.1	0.6	0.4	0.5	0.4	0.6	0.5	0.4	1.3
0.0	1.2	0.4	0.5	0.0	0.0	0.3	0.0	0.0	0.2	0.2	0.0	0.3	0.5	0.4	0.0
0.3	0.0	0.0	0.7	1.7	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.5	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.0
3.6	2.3	1.6	1.9	1.4	3.8	1.3	3.1	3.2	3.8	2.5	3.0	1.2	3.1	2.9	2.0
0.5	0.2	0.7	0.2	0.3	1.1	2.0	1.6	5.8	1.8	1.0	3.4	0.9	2.1	1.0	1.6
1.6	0.5	0.7	3.3	4.7	1.9	2.3	1.8	1.9	2.9	2.2	1.3	1.5	1.0	1.9	1.6
0.0	0.5	0.4	0.9	0.0	0.0	1.0	0.4	0.0	0.4	0.2	0.6	0.0	0.0	0.2	0.7
0.8	0.2	0.4	0.2	1.9	0.3	0.5	0.7	0.6	0.2	0.2	0.9	0.6	0.5	0.2	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.2	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0
0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.2	0.0	0.0	0.2	0.0	0.0	0.5	0.0	0.0
0.3	0.0	1.1	0.7	0.3	0.0	0.0	0.9	0.0	0.0	0.0	1.1	0.9	1.3	0.2	1.3
0.0	0.2	0.0	0.0	0.0	0.5	0.3	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
0.0	0.2	0.4	1.2	0.3	0.3	1.0	2.0	1.3	1.8	0.5	0.6	0.0	0.0	1.5	0.4
0.0	0.5	0.2	0.2	0.3	0.0	0.8	0.4	0.3	0.2	0.2	0.0	0.3	0.0	0.4	0.4
0.3	0.0	0.0	0.2	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.4	0.0	0.0	0.6	0.2
0.5	1.2	0.7	0.5	0.3	0.5	0.5	0.2	0.0	0.4	0.5	0.2	0.6	0.5	0.4	0.7
0.5	0.2	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.2	0.4
0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0
0.0	0.2	0.7	0.0	0.6	0.3	0.0	0.0	0.3	0.2	0.2	0.2	0.3	0.5	0.0	0.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.4	3.3	4.0	2.8	5.0	4.9	3.8	2.7	2.2	0.9	1.7	3.0	2.2	1.6	1.0	1.3
0.0	0.5	0.9	0.5	0.6	0.3	0.0	0.4	0.0	1.6	0.2	0.6	0.6	1.0	0.6	0.2
0.5	0.7	0.4	0.9	0.8	1.4	0.3	0.9	0.3	0.2	0.0	0.4	0.0	0.5	0.6	0.9
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.4	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
0.3	0.2	0.4	0.0	0.0	0.0	0.3	0.7	0.0	0.2	0.2	0.2	0.6	0.0	0.0	0.4
0.0	0.0	0.2	0.0	0.0	1.1	0.8	0.0	0.0	0.0	0.7	0.6	0.6	0.3	0.0	0.7
0.8	0.0	0.0	0.0	0.6	0.0	0.5	1.6	0.3	0.2	1.0	0.9	0.6	0.3	0.2	0.9

Table 1. Number and percentage

Sample															
79	81	83	85	89	91	94	97	101	105	106	108	112	115	116	118
6.4	7.7	5.2	3.8	7.5	8.1	8.8	5.9	11.4	10.5	13.5	8.6	10.9	6.9	6.1	3.8
3.0	3.1	1.4	3.2	1.4	2.0	1.7	1.2	4.6	4.9	4.5	4.0	4.9	4.0	5.0	3.6
3.0	2.0	3.3	1.7	1.4	2.5	1.9	1.8	5.3	2.7	5.6	2.4	1.5	2.3	1.7	1.2
0.0	0.0	0.0	0.0	0.8	0.7	0.0	0.6	1.5	3.1	2.1	0.7	1.5	1.5	0.0	1.4
0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.9	0.0
8.6	5.4	7.7	7.5	8.0	10.6	12.7	11.5	8.8	7.8	6.9	3.6	4.0	3.8	3.5	3.6
0.0	0.3	0.0	0.2	0.0	0.2	0.0	0.4	0.2	0.2	0.0	0.2	0.2	0.0	0.0	0.0
4.9	3.8	6.4	3.6	6.1	5.9	4.1	6.1	3.7	4.9	5.1	5.9	2.6	3.8	0.9	2.6
3.0	2.8	1.7	3.4	2.2	3.2	2.8	3.6	3.5	2.9	4.3	2.9	1.7	1.0	4.4	2.6
0.2	0.5	1.1	0.9	0.5	0.0	0.8	1.6	0.9	0.4	1.7	1.7	0.4	1.0	0.0	0.9
0.2	0.3	1.1	2.3	0.8	0.0	0.0	0.6	1.1	0.0	0.2	1.0	0.6	0.0	0.6	0.0
0.0	0.5	0.0	0.2	0.3	0.2	0.3	0.0	0.0	0.0	0.2	0.0	0.2	0.4	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.4	0.0	0.2	0.3	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
2.0	4.6	3.6	1.7	1.4	1.5	0.3	2.8	1.8	2.0	1.3	1.2	3.0	3.8	3.5	4.5
0.5	2.6	2.5	1.3	0.5	0.7	0.8	1.6	0.9	1.8	1.7	1.7	4.3	1.9	1.7	3.3
1.2	1.0	1.7	2.1	1.7	1.5	2.8	2.8	2.9	2.5	3.0	2.2	2.5	0.7	2.9	1.2
0.5	0.0	0.3	1.1	0.8	1.0	0.8	1.4	0.9	0.2	0.4	1.0	0.6	0.6	0.0	0.0
0.7	1.3	0.3	0.0	0.3	0.5	0.3	0.4	0.7	0.9	0.6	0.0	0.4	0.6	0.3	0.5
0.2	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0
0.0	0.3	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.3	0.0
0.7	0.5	0.0	0.4	0.0	0.0	0.3	0.8	0.7	1.1	1.5	2.0	2.3	1.5	1.5	0.7
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.7
0.5	0.0	0.0	0.6	0.0	0.7	0.8	0.6	0.4	1.1	0.9	0.9	0.8	0.2	0.0	0.5
0.2	0.8	0.0	0.2	0.3	1.0	0.3	0.0	0.4	0.0	0.2	0.7	0.2	0.6	0.0	0.5
0.5	0.3	0.8	0.4	0.5	0.5	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
0.2	0.5	0.6	0.0	0.5	0.7	0.8	0.8	1.1	0.9	0.6	1.9	1.1	2.1	1.2	0.2
0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.6	0.2	0.0	0.2	0.5	0.4	0.6	0.0	0.0
0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.0
0.2	0.3	0.3	0.0	0.5	0.5	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.2	0.0	0.0	0.0
0.2	0.0	0.6	0.0	0.0	0.5	0.3	0.0	0.4	0.0	0.0	0.3	0.8	0.0	0.3	0.0
3.2	2.0	2.2	2.6	1.4	1.0	1.9	1.6	2.4	2.0	2.8	2.2	3.4	2.9	0.6	3.8
0.2	1.8	0.8	1.3	1.1	1.5	1.9	1.0	0.7	1.6	0.2	1.2	0.8	0.8	0.3	1.4
0.2	0.0	0.3	1.3	0.3	0.7	0.8	1.0	0.9	0.2	0.6	0.3	0.2	1.3	1.2	1.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.7	0.5	0.3	0.0	0.0	0.0	0.0	0.0	1.3	1.6	0.4	0.5	1.1	3.2	3.8	2.1
0.0	1.3	1.7	0.9	0.5	1.7	1.4	0.2	0.0	0.0	0.2	0.0	0.0	1.0	0.0	0.7
0.2	0.8	0.3	0.6	1.1	1.0	0.6	0.6	0.7	0.2	0.2	0.5	0.0	0.2	0.6	0.2

of palynomorphs (1st section continued)

number															
120	123	124	125	127	129	131	132	134	136	138	142	143	144	146	148
7.0	10.1	10.2	8.3	9.8	5.1	10.1	8.9	5.3	9.2	6.4	3.5	12.3	8.5	12.3	7.6
6.0	5.1	3.7	9.0	3.9	2.2	2.3	1.5	4.2	4.5	4.8	1.1	6.3	8.0	5.1	3.2
3.9	3.9	3.1	3.3	3.4	2.2	1.8	2.2	1.4	1.8	3.3	1.1	3.4	1.9	6.7	1.9
1.8	1.8	1.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	1.2	1.9	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.3	0.0	1.0	0.0	0.3
4.1	3.0	2.4	2.4	5.1	2.4	0.8	1.7	0.6	0.3	0.3	0.8	1.0	0.5	0.8	0.6
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.9	2.3	1.4	1.9	0.5	2.7	1.3	1.5	0.3	0.0	0.5	0.5	1.0	0.2	0.3	0.6
3.7	4.8	1.4	4.8	5.6	2.2	8.0	6.7	4.5	9.7	6.6	3.5	13.3	6.8	9.7	9.8
2.7	1.6	1.4	0.0	1.7	0.5	2.3	2.5	2.0	0.3	1.3	1.6	2.3	2.9	2.8	4.1
0.2	0.0	0.0	0.5	0.7	0.0	0.0	0.0	0.3	0.0	0.3	0.0	1.0	0.0	0.8	0.6
0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.3	0.0	0.0	0.3	0.0
0.0	0.0	0.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.3
4.3	4.1	3.9	4.0	5.1	6.2	4.9	3.2	4.5	2.6	2.8	5.4	0.8	2.7	0.8	2.8
3.7	3.5	3.1	0.7	4.4	2.2	1.8	2.2	2.8	2.9	2.3	5.7	1.3	2.2	1.5	2.5
1.0	2.3	3.1	1.0	0.5	0.8	0.0	1.0	0.3	2.6	0.5	1.4	1.8	2.4	1.0	0.6
0.4	0.0	0.0	0.0	0.7	0.0	0.5	0.2	0.0	0.0	0.0	0.3	0.8	0.0	0.3	0.0
0.2	0.2	0.0	0.2	0.0	0.0	0.0	0.2	0.6	0.0	0.3	0.0	0.5	0.7	0.0	0.6
0.0	0.0	0.0	0.5	0.0	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.9	1.6	1.6	0.0	1.7	1.6	0.5	1.5	1.4	1.8	0.5	1.9	1.8	1.0	2.1	1.3
0.0	0.0	0.0	0.7	0.5	1.3	0.8	0.0	0.0	0.3	0.0	1.4	0.3	0.7	0.5	0.6
0.4	0.0	0.2	0.0	0.2	0.0	0.3	0.2	0.6	0.0	0.3	0.3	0.0	0.2	0.0	0.3
1.0	0.7	0.8	0.5	0.5	1.6	1.3	0.2	0.3	0.0	0.0	0.3	0.5	0.0	1.0	1.6
1.0	0.9	0.8	0.7	0.0	0.5	1.3	0.2	0.3	0.0	0.3	0.8	0.3	0.4	0.3	0.3
0.4	0.2	0.0	0.5	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0
0.6	0.9	0.8	1.0	1.7	0.3	0.5	0.7	0.8	1.0	0.3	0.5	0.8	0.7	0.3	0.0
0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.2	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0
0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.2	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.6	2.5	1.8	1.0	2.4	0.5	1.5	1.5	0.0	0.5	0.5	0.3	0.8	0.7	0.5	1.3
2.5	3.7	2.4	0.5	1.0	1.3	0.8	1.2	1.1	0.0	1.3	0.0	1.3	1.0	0.5	0.3
1.4	0.9	1.0	0.2	2.0	0.8	2.3	1.0	2.0	0.5	0.8	0.8	1.0	1.0	0.0	1.3
0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0	3.7	2.6	0.2	0.7	2.7	1.5	0.0	1.1	2.1	0.8	1.4	1.8	0.0	1.0	0.0
0.8	0.2	0.0	0.2	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.6	0.5	1.2	1.0	0.2	0.8	0.0	0.7	0.6	0.5	0.3	0.3	0.0	0.0	1.5	0.3

Table 1. Number and percentage

Taxa	K6	K4	K2	K1	1	3	9	11	15
Tricolpopollenites ellipticus	3.6	0.0	0.2	0.0	0.0	3.2	0.0	0.0	1.0
T. elongtus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sparganiaceaepollenites taiwanensis	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
Rubuspollenites formosensis	0.6	0.2	0.2	0.0	0.2	0.3	0.0	0.3	0.5
Tricolpopollenites morrisonensis	0.3	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0
Gemmatricolporites pedunculata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tricolporopollenites miocenus	0.3	0.2	0.0	0.0	0.0	0.8	0.0	0.0	0.0
Slowakipollis taiwanensis	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Loniceraepollis japonicus	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
Ageratumpollenites taiwanensis	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.3
Dichrocephalapollenites taiwanensis	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
Cichoreacidites taiwanensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hemisteptapollenites hyratus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Artemisiaepollenites annus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sporotrapoidites llingensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Margoaperturates taiwanensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Paraphlomipollenites taiwanensis	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.0
Retihexacolpites taiwanensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tricolporopollenites repens	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Patriniapollenites taiwanensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tricolporopollenites asper	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rutaceoipollenites taiwanensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gardeniapites taiwanensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Malvacearumpollis taiwanensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corsinipollenites peploides	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Margocolporites vanwijhei	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Assamialetes taiwanensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trachelospermumpollenites taiwanensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sabalpollenites taiwanensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arecipites taiwanensis	0.8	0.2	0.0	0.0	0.0	2.9	1.8	0.8	0.0
Monosulcites formosensis	0.6	0.0	0.2	0.0	0.2	0.3	0.2	0.0	0.3
Couperipollis taiwanensis	0.6	0.7	0.2	0.0	0.4	1.1	0.2	0.8	0.0
Taxa number of angiosperms	31	30	33	18	33	33	26	29	31
Sum of angiospermous percentage	53.4	47.2	56.0	53.7	59.1	54.9	46.1	43.9	48.1
Taxodiaceae-Cupressaceae-Taxaceae	18.2	14.4	13.1	13.5	14.2	15.3	19.5	17.5	20.4
Pityosporites massoniana	6.1	5.0	2.4	4.5	3.5	2.6	4.1	5.6	3.3
P. acutus	0.8	3.7	0.9	3.3	1.8	0.8	3.0	2.0	1.8
P. morrisonicola	1.4	0.7	0.4	0.4	0.2	0.8	0.7	0.3	0.0
P. oblongus	0.6	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
P. zonalatatus	0.3	0.2	0.0	0.0	0.0	0.0	0.2	0.0	0.0
P. triangulatus	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P. scabratus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

of palynomorphs (2nd section continued)

Sample number															
21	23	25	31	35	39	42	47	49	53	64	68	69	71	74	75
0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	1.1	0.2	0.4	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.0
0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.4	0.0
0.8	0.9	0.7	0.0	0.0	0.5	0.0	0.4	0.0	0.2	0.0	0.0	0.0	0.5	0.2	0.2
0.5	0.0	0.2	0.2	0.3	0.0	0.0	0.0	0.0	0.4	0.2	0.4	0.0	0.0	0.0	0.2
0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.2	0.0	0.4	1.0	1.1	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.2
0.0	0.5	0.4	0.2	0.3	0.0	0.0	0.0	0.6	0.0	0.5	0.4	0.0	0.8	0.2	0.2
0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.5	0.0	0.0	0.3	0.0	0.7
0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.7	0.6	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.4	0.2	0.3	0.0	0.8	0.2	0.0	0.4	0.2	0.0	0.3	0.0	0.6	0.2
0.5	0.7	0.0	0.2	0.3	1.1	1.0	1.1	0.3	0.2	0.2	0.9	0.0	0.3	0.0	0.4
27	31	33	31	32	27	30	35	21	34	38	37	25	31	34	37
50.7	49.5	49.3	61.4	54.0	45.6	47.7	51.9	47.8	41.1	42.3	57.9	47.4	48.8	41.5	57.9
16.7	18.9	16.1	11.9	15.6	28.0	23.6	18.3	14.1	8.3	24.0	21.6	24.5	26.5	10.0	21.2
1.6	1.9	4.2	0.7	6.4	3.0	7.6	4.2	9.9	7.1	3.5	1.9	5.0	4.7	4.8	2.4
1.6	3.0	4.0	3.7	0.8	1.9	1.0	1.8	0.6	0.9	1.2	0.2	0.3	0.8	3.8	0.4
0.3	0.0	0.7	0.0	0.0	0.3	0.0	0.9	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.2	0.0	0.0	0.2	0.0
0.5	0.2	0.0	0.2	0.3	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.2	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0

Table 1. Number and percentage

Sample															
79	81	83	85	89	91	94	97	101	105	106	108	112	115	116	118
0.0	0.0	0.3	0.0	0.0	0.5	0.3	0.2	0.0	0.0	0.0	0.0	0.4	0.6	0.0	0.7
0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.0	0.4	0.0	1.2
0.2	0.0	0.3	0.6	0.3	0.5	0.8	0.6	0.2	0.0	0.2	0.4	0.0	0.4	0.0	0.6
0.5	0.3	0.0	0.9	0.0	0.2	0.0	0.2	0.0	0.4	0.0	0.0	0.0	0.4	0.0	0.2
0.2	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.7	0.0	0.0	0.0	0.2	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.2	0.5	0.2	0.0	0.2	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0
0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0
0.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.2	0.2	0.0	0.2	0.3	0.2	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.3	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.4	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.2	0.0	0.0
0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.2	0.0	0.0	0.2	0.3	0.7	0.0	0.0	0.4	0.2	0.0	0.3	0.4	0.2	0.9	1.2
0.2	0.0	0.0	0.4	0.0	0.0	0.8	0.4	0.0	0.2	0.0	0.0	0.0	0.6	1.2	0.5
0.2	0.5	0.6	1.3	0.5	0.0	0.3	0.4	0.7	0.4	0.2	0.7	1.3	0.6	0.9	1.2
38	33	29	34	31	33	29	35	38	33	35	33	41	37	28	32
45.4	46.9	44.8	46.1	42.3	51.1	49.7	53.8	61.4	56.7	62.1	50.9	54.5	51.5	44.9	46.9
19.8	24.2	29.0	18.3	17.4	17.9	18.5	15.0	16.7	17.0	18.2	21.8	19.6	18.8	24.2	23.9
5.2	2.6	2.2	1.5	4.1	2.5	3.6	2.0	1.3	2.7	1.3	2.2	3.0	2.9	4.4	4.3
1.0	0.8	1.4	1.3	1.1	1.5	3.0	1.2	0.7	0.7	1.7	0.7	0.6	0.7	0.0	0.9
0.0	0.5	0.3	1.3	0.3	0.2	0.3	0.8	0.0	0.4	0.4	0.0	0.2	0.6	0.3	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.4	0.4	0.3	0.9
0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5

of palynomorphs (2nd section continued)

number

120	123	124	125	127	129	131	132	134	136	138	142	143	144	146	148
0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.2	1.1	0.3	0.0	0.5	0.8	1.2	2.3	0.9
0.2	0.0	0.8	0.7	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.9	0.0	0.0	0.0	0.0	0.3	0.0	0.8	1.0	0.8	0.3	0.5	0.0	0.0	0.0
0.2	0.2	0.2	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
0.4	0.2	1.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.3	0.8	0.0	0.5	0.0
0.2	0.0	0.0	0.0	0.5	1.1	0.3	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.3	0.0	0.0	0.2	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.2	0.5	0.2	0.0	0.0	0.0	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.3	0.0	0.0	0.0	0.3	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.7	1.0	0.0
1.9	0.0	0.2	1.7	0.7	3.5	3.6	1.2	1.4	1.8	2.3	2.7	1.0	3.1	3.8	2.5
0.0	0.2	0.0	0.5	0.5	0.8	0.5	0.2	0.3	0.8	0.5	0.8	0.5	0.2	0.3	0.6
1.4	1.4	0.4	0.2	1.7	1.6	1.3	2.2	0.3	0.8	0.5	0.5	0.3	1.0	1.0	0.3
37	33	36	33	33	32	33	32	30	23	28	32	32	29	29	28
60.1	65.4	54.8	50.0	58.4	47.0	51.5	46.0	40.0	45.5	38.8	39.7	59.5	52.2	59.0	47.5
14.4	14.1	18.9	22.8	19.3	21.2	21.6	30.7	35.0	30.6	34.2	20.9	16.2	17.4	24.9	20.6
2.7	0.9	0.8	5.2	0.5	3.8	1.5	0.2	3.4	1.6	2.6	4.3	3.9	2.7	0.8	4.4
2.9	1.4	4.0	0.7	1.0	1.6	0.0	0.0	0.0	0.0	0.5	1.4	0.5	0.0	0.5	1.6
0.0	0.5	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.2	0.3	0.0
0.8	0.0	0.2	0.2	0.0	0.3	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.2	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 1. Number and percentage

Taxa	K6	K4	K2	K1	1	3	9	11	15
Zonalapollenites chinensis	3.1	1.8	1.3	1.2	2.2	4.5	0.7	1.4	1.5
Z. taiwanensis	0.3	0.5	1.7	0.8	1.8	0.5	1.4	1.7	0.8
Abiespollenites formosensis	3.1	1.8	0.4	0.4	0.4	0.3	0.9	2.3	1.5
A. oblongus	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Piceapollis acutosaccatus	1.4	1.1	0.0	0.8	0.7	2.4	0.2	0.0	0.8
Cycadopites gracilis	0.0	0.0	0.7	0.0	0.7	0.5	0.2	0.3	1.5
C. ellipticus	0.3	0.0	0.0	0.4	0.0	0.8	1.1	0.6	0.0
Podocarpidites taiwanensis	0.3	0.7	0.7	0.8	0.7	0.0	0.5	1.1	2.0
P. beugii	0.0	0.2	0.2	0.0	0.2	0.0	0.2	1.7	0.3
P. conjunctus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Longicorpuspollenites taiwanensis	0.0	1.1	0.0	0.4	0.0	0.3	0.2	0.0	0.0
Dacrydiumites taiwanensis	0.6	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0
D. magnus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Keteleeriaepollenites taiwanensis	1.1	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0
Ephedripites taiwanensis	0.0	0.0	0.7	0.0	0.0	0.0	0.2	0.0	0.0
E. tertiarius	0.0	0.2	0.7	0.0	0.0	0.0	0.0	0.0	0.0
E. kuanyinshanensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E. ellipticus	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
E. multus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Seguoiapollenites taiwanensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hesperopeucepollenites pattoniana	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Taxa number of gymnospems	15	14	12	11	12	12	16	11	10
Sum of gymnospermous percentage	35.2	32.1	30.5	26.6	26.5	29.8	34.1	34.4	33.8
Laevigatosporites gracilis	3.9	8.9	3.7	9.0	6.6	3.7	9.3	11.8	6.6
L. tenui-lunatus	0.8	0.7	0.4	0.4	0.2	1.1	0.9	0.6	0.8
Magnastriatites grandiosus	0.8	1.6	1.5	2.9	1.3	2.4	1.6	3.7	1.8
Cicatricosisporites australiensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C. taiwanensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C. formonensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gemmamonoletes formosensis	1.1	1.1	1.3	0.4	1.8	0.3	0.9	0.3	0.0
G. oblongo-lunatus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Toroisporis taiwanensis	0.0	1.1	1.5	1.2	0.4	0.8	0.5	1.1	1.3
Concavitriletes taiwanensis	0.6	1.1	1.3	0.5	0.2	0.5	0.9	0.8	0.8
Latosporites taiwanensis	1.1	0.5	0.2	0.4	0.2	0.5	0.2	0.3	0.5
Polypodiaceoisporites sstuloso-costulatus	0.0	0.5	0.2	0.8	0.0	0.0	0.7	0.0	0.8
P. emarginatus	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
P. intrabalticus	0.0	0.2	0.0	0.0	0.0	0.0	0.2	0.0	0.0
P. baculatus	0.0	0.0	0.0	0.0	0.2	0.3	0.2	0.0	0.0
P. nipponicus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P. venustus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P. dactylinus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P. intragigantibalticus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

of palynomorphs (3rd section continued)

Sample number															
21	23	25	31	35	39	42	47	49	53	64	68	69	71	74	75
0.5	0.5	0.4	1.4	1.1	0.8	1.5	0.9	1.3	1.6	1.7	2.1	1.9	1.0	2.9	1.1
0.5	1.2	1.3	0.7	1.4	2.2	1.0	0.9	2.9	2.0	0.7	1.3	1.2	0.3	2.1	1.3
0.5	1.9	1.3	1.2	1.9	0.9	1.0	1.6	0.3	2.7	2.5	0.2	0.6	0.8	1.3	0.7
0.0	0.0	0.4	0.5	0.3	0.3	0.0	0.4	0.0	0.7	0.5	0.0	0.0	0.0	0.6	0.0
0.0	0.5	0.0	0.9	0.6	0.3	0.8	0.7	1.3	1.1	0.5	0.2	0.0	0.0	0.2	0.2
0.3	0.5	0.7	0.2	0.6	0.8	1.5	0.4	0.0	0.0	0.7	0.6	0.6	0.3	0.6	0.2
0.8	0.5	0.9	0.7	1.4	0.3	0.3	0.9	0.5	0.0	0.5	0.4	0.0	0.0	0.2	0.2
0.8	0.5	1.3	1.2	1.1	1.1	0.8	1.1	1.0	3.6	0.5	0.0	0.0	0.0	3.5	0.0
0.0	0.2	1.3	0.7	1.4	0.8	0.8	0.9	0.0	0.7	0.0	0.0	0.3	0.0	0.4	0.0
0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.3	0.0	0.2	1.2	0.6	0.5	0.0	0.0	0.3	0.4	0.0	0.2	0.3	0.0	0.0	0.0
0.3	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.2	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.5	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	13	15	16	14	15	11	14	10	18	12	11	9	7	15	10
25.2	29.1	33.0	25.6	33.4	42.6	39.8	33.2	32.4	31.5	37.6	29.1	34.7	34.3	31.0	28.1
9.3	7.2	8.5	6.7	6.7	5.8	5.3	8.0	9.0	7.1	9.4	4.7	6.8	7.0	5.2	6.0
1.4	1.6	0.7	0.5	0.8	0.3	0.8	0.9	0.6	0.2	0.2	0.4	0.3	0.5	0.4	0.9
1.4	1.9	1.1	1.4	1.1	3.6	1.0	1.8	1.0	4.0	2.0	0.4	0.6	0.5	2.5	0.9
0.0	0.0	0.0	0.0	0.3	0.3	0.0	0.2	0.0	0.0	0.2	0.0	0.3	0.3	0.0	0.0
0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.0	0.0	0.2	0.0	0.0	0.3	0.0	0.0	0.0
0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.5	2.1	0.0	0.2	0.6	0.0	0.0	0.9	1.0	2.9	1.0	0.6	0.9	0.0	2.7	0.9
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.6	1.4	0.9	1.2	0.6	0.3	0.3	0.2	0.0	1.3	0.5	1.5	0.6	1.3	3.8	0.7
0.0	0.9	0.7	0.0	0.3	0.3	0.8	0.4	2.2	0.4	0.5	0.4	0.9	0.5	1.0	0.2
0.3	0.9	0.2	0.0	0.3	0.8	0.3	0.0	0.3	0.2	0.2	0.6	0.3	0.8	1.5	0.2
0.0	0.2	0.7	0.2	0.0	0.0	0.5	0.4	1.0	0.2	0.2	0.4	0.6	0.5	0.4	0.2
0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.6	0.2	0.5	0.0	0.0	0.0	0.0	0.7
0.5	0.0	0.0	0.2	0.0	0.0	0.3	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.2	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.3	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 1. Number and percentage

Sample															
79	81	83	85	89	91	94	97	101	105	106	108	112	115	116	118
2.0	0.8	1.1	0.9	1.1	0.5	1.4	1.2	0.7	2.2	0.4	1.2	0.6	1.5	0.3	1.4
1.5	1.0	1.3	0.9	2.8	2.7	0.8	2.0	0.7	2.0	0.4	1.0	0.9	1.0	0.0	2.4
1.5	1.3	0.8	0.6	0.8	0.7	0.8	1.2	0.4	1.1	0.6	0.5	0.8	1.0	1.5	0.2
0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.6	0.2
0.0	0.3	0.3	0.6	0.3	0.0	0.0	0.2	0.0	0.0	0.4	0.0	0.4	0.2	1.7	0.7
0.7	0.3	0.6	0.9	0.8	0.0	0.8	1.4	1.5	0.7	0.9	1.4	0.8	0.4	1.2	3.1
0.7	0.0	0.0	0.2	0.0	0.2	0.6	1.2	0.4	1.3	1.1	1.7	0.8	0.6	0.9	0.9
1.7	0.7	0.0	0.4	0.6	0.0	0.0	0.0	0.0	0.4	0.0	0.2	0.4	0.2	0.0	0.0
0.0	0.0	0.0	0.0	1.7	1.0	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.7	0.0	0.0	0.2	0.0	0.0	0.0
0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.2	0.7	0.2	0.0	0.0	0.2	0.4	0.3	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.3	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2
0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	11	9	12	12	9	12	13	9	12	13	9	15	14	15	14
35.3	32.7	37.0	27.1	31.2	24.3	30.9	27.1	23.0	29.5	26.6	30.7	29.4	30.0	36.7	37.7
5.9	5.4	6.1	8.1	6.7	5.4	5.1	5.5	4.4	4.0	4.1	4.1	6.2	6.0	7.9	5.0
0.2	1.0	0.6	1.1	1.1	1.0	1.0	0.4	0.4	0.4	0.9	0.2	0.9	0.8	2.0	1.2
2.0	4.8	2.5	6.4	7.7	4.9	2.8	2.8	0.9	1.5	1.9	1.9	1.3	1.5	0.6	0.9
0.0	0.0	0.0	0.2	0.3	0.5	0.0	0.4	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.7	0.3	1.7	2.1	0.8	0.0	0.6	1.2	0.9	1.3	0.9	1.7	0.9	1.5	0.0	1.2
0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.7
0.7	1.0	0.3	0.4	0.0	0.0	0.8	0.8	0.0	0.9	0.2	2.8	0.6	0.8	0.0	0.9
1.5	1.0	0.0	0.4	1.4	0.7	0.3	0.6	0.9	0.0	0.4	1.0	0.4	0.2	0.3	0.5
0.2	0.3	0.6	0.9	1.1	0.7	0.6	0.6	0.7	0.2	0.2	0.7	0.6	1.0	0.3	1.2
0.2	0.3	0.6	0.0	0.3	1.0	0.6	1.0	1.1	0.9	0.6	0.7	1.3	0.4	0.0	0.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0
0.0	0.0	0.3	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0

of palynomorphs (3rd section continued)

number															
120	123	124	125	127	129	131	132	134	136	138	142	143	144	146	148
0.6	0.5	0.4	0.2	1.0	2.7	0.5	0.5	2.2	1.6	1.8	3.3	0.5	1.4	0.0	4.7
0.6	1.2	0.2	0.0	1.2	0.0	1.0	0.5	0.3	0.0	0.0	0.5	0.0	1.0	0.0	1.0
0.0	0.0	0.6	0.2	0.0	0.5	0.3	0.0	0.3	0.0	0.8	0.5	0.3	0.5	0.5	1.0
0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.7	0.2	0.0	0.2	0.0	1.0	0.7	0.6	0.0	0.5	2.4	0.8	2.2	1.0	0.3
0.8	1.2	2.2	0.7	2.2	0.8	0.0	1.2	0.8	1.0	1.0	0.8	1.3	1.2	1.5	1.6
1.0	0.5	0.8	0.8	1.2	2.2	0.0	0.5	0.6	1.0	0.8	1.6	0.8	0.7	1.0	1.6
0.6	0.5	0.0	0.2	0.0	0.3	0.3	0.0	0.3	0.0	0.0	0.3	0.0	0.0	0.0	0.0
0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.4	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.3	0.0
0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	11	12	18	8	12	8	7	9	5	9	16	8	9	9	9
25.1	21.4	29.9	34.7	26.7	34.9	27.3	34.4	43.4	35.9	42.3	38.9	24.3	28.3	31.0	36.7
2.1	5.5	3.9	8.6	5.9	6.7	6.2	8.2	9.2	6.8	4.3	6.5	6.8	7.5	2.8	3.5
1.4	0.9	1.2	0.5	1.5	2.7	1.3	1.2	1.1	1.6	1.0	1.9	1.3	1.9	1.5	1.6
0.2	0.5	1.2	0.5	1.0	0.5	1.5	1.5	0.0	0.8	1.3	1.4	0.5	0.7	0.5	1.3
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
1.8	1.4	1.0	0.2	1.2	0.0	1.5	1.5	0.8	1.8	2.8	1.4	1.8	1.4	0.8	1.0
0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.9	0.5	1.0	0.2	0.2	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.8	0.5	0.0	0.6
0.2	0.0	0.2	1.0	0.2	0.3	2.1	0.7	0.3	0.5	0.0	1.4	0.5	0.5	0.8	0.6
0.6	0.5	0.6	0.0	1.2	1.1	1.0	0.2	1.4	1.0	1.0	0.5	0.3	1.2	0.8	1.3
1.2	0.7	0.0	0.5	0.5	0.0	0.0	0.2	0.3	1.0	2.3	0.3	2.3	1.0	0.5	0.6
0.4	0.2	0.2	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.3	0.0	0.2	0.0	0.3
0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.2	0.2	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.3	0.0	0.0	0.0	0.3	0.0	0.0	0.0

Table 1. Number and percentage

Taxa	K6	K4	K2	K1	1	3	9	11	15
Verrucingulatisporites baculatus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Polypodiaceoisporites wallichianus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P. ensiformis	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
P. gracilimus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Verrucatosporites balticoides	0.0	0.5	0.0	0.0	0.4	0.3	0.7	0.3	0.5
V. balticoides minor	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.3	0.3
V. reniformis	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
V. lunatus	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Leiotriletes taiwanensis	0.0	0.7	0.0	0.4	0.2	0.3	0.5	0.3	0.3
L. sphaerotriangulus	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.3
L. magnus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
L. ellipticus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Perinomonoletes granulatus	0.3	0.7	1.3	2.0	0.4	0.3	0.9	0.3	0.5
P. lato-reticulatus	0.0	0.0	0.2	0.0	0.0	0.0	0.5	0.0	0.3
P. lato-reticulatus punctatus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P. reticulatus scabrato-marginatus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sphagnumsporites stereoides	0.3	0.5	0.4	0.0	0.0	0.8	0.2	0.0	0.8
S. formosensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gemmatosporis taiwanensis	0.6	0.5	0.0	0.0	0.2	0.3	0.0	0.0	0.3
G. lato-apertus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Crassoretitriletes vanraadshooveni	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
Echinosporis taiwanensis	0.0	0.0	0.0	0.0	0.0	0.3	0.9	0.6	0.8
Gemmatotriletes formosensis	0.3	0.0	0.0	0.0	0.4	0.0	0.0	0.3	0.5
Foveotriletes serratus	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.3	0.3
F. formosensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Retitriletes taiwanensis	0.0	0.5	0.0	0.4	0.7	0.0	0.2	0.3	0.0
Intrapunctosporis taiwanensis	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
Cingulatisporites taiwanensis	0.3	0.0	0.0	0.0	0.0	0.3	0.2	0.0	0.0
Extrapunctatosporis taiwanensis	0.0	0.5	0.0	0.0	0.2	0.8	0.0	0.0	0.3
Corrusporis taiwanensis	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
Anthocerisporis formosensis	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A. taiwanensis	0.6	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A. reticulatus	0.0	0.0	0.2	0.0	0.0	0.3	0.0	0.0	0.5
Lunulasporites taiwanensis	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
Cibotiumsporites cumingus	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0
C. barometz	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Toricingulatisporites taiwanensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gleicheniidites formosensis	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Schizaeoisporites taiwanensis	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Granulatisporites formosensis	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
Punctatisporites formosensis	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.3
Triplanosporites minor	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0

of palynomorphs (4th section continued)

Sample number															
21	23	25	31	35	39	42	47	49	53	64	68	69	71	74	75
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.4	0.5	0.0	0.0	0.0	0.0	0.3	0.0	0.0	1.1	0.5	0.0	1.5	0.3	1.5	0.7
0.8	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.2	0.2	0.2	0.3	0.5	0.2	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.5	0.0	0.2	0.3	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
1.1	1.5	0.9	0.2	0.8	0.3	0.8	0.4	0.6	0.7	0.2	0.0	0.6	0.8	0.4	0.0
0.3	0.5	0.7	0.7	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0	1.7	0.7
0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.8	0.9	0.0	0.2	0.0	0.0	0.3	0.0	0.0	0.2	0.5	0.6	0.6	1.0	0.4	0.4
1.1	0.2	0.0	0.0	0.0	0.0	0.0	0.7	1.0	0.7	0.2	1.5	0.3	0.0	0.4	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.5	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.0	0.2	0.0
0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.4	0.2
0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.2	0.0	1.3	1.0	0.4	0.0	0.3	0.0	0.2
0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	1.1	0.5	0.0	0.0	0.0	0.4	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
0.5	0.5	0.9	0.0	0.0	0.0	0.5	0.0	0.6	0.4	0.0	0.2	0.0	0.5	0.4	0.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.3	0.5	0.0	0.0
0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.2	0.3	0.0	0.2	0.0	0.3	0.0	1.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.6	0.3	0.0	0.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.2
0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
0.0	0.0	0.4	0.0	0.0	0.0	0.3	0.0	0.0	0.4	0.2	0.0	0.0	0.0	0.4	0.0
0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.2	0.0
0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0
0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
0.3	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.3	0.4	0.0	0.0	0.0	0.0	0.2	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 1. Number and percentage

Sample															
79	81	83	85	89	91	94	97	101	105	106	108	112	115	116	118
0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.5	0.3	0.0	0.4	0.6	0.7	0.8	0.2	0.7	0.9	0.0	0.2	0.4	1.0	0.0	0.2
0.0	0.0	0.0	0.4	0.3	1.2	0.0	0.4	0.0	0.2	0.0	0.5	0.4	1.3	0.0	0.0
0.0	0.3	0.0	0.4	0.3	0.0	0.3	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
0.2	0.5	0.0	0.6	0.3	0.0	0.6	0.4	0.9	0.2	0.0	1.4	0.0	0.0	0.0	0.2
0.2	0.8	0.3	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	1.1	0.8	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0	0.0	0.8	0.0	0.0	0.0	0.6	0.4	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0
0.5	0.3	0.0	0.4	0.3	0.0	0.3	0.2	0.4	0.7	0.2	0.0	0.4	0.0	0.0	0.5
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.5	0.0	0.4	0.3	0.5	1.1	0.2	0.0	0.0	0.0	0.0	0.2	0.2	1.7	0.2
0.2	0.3	1.3	0.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.2
0.2	0.5	0.0	0.2	1.4	0.2	0.3	0.2	0.4	0.2	0.0	0.0	0.0	0.2	0.0	0.0
0.5	0.3	0.6	0.0	0.6	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.4	0.0	1.7	0.0
0.7	0.3	0.6	0.6	0.3	0.5	0.0	0.0	0.2	0.2	0.2	0.0	0.0	0.2	0.0	0.0
0.2	0.3	0.0	0.4	0.0	0.5	0.0	0.0	0.7	0.4	0.2	0.2	0.2	0.4	0.0	0.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.5	0.3	0.3	0.2	0.0	0.2	0.3	0.0	0.0	0.2	0.0	1.0	0.2	0.4	0.0	0.7
0.2	0.5	0.0	0.0	0.0	0.2	0.0	1.0	0.0	0.0	0.0	0.3	0.2	0.6	0.0	0.5
0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.2	0.4	0.2	0.5	0.2	0.6	0.0	0.2
0.0	0.0	0.3	0.4	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.2	0.0	0.3	0.2
0.0	0.3	0.0	0.2	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.2	0.0	0.3	0.0	0.0	0.2	0.6	0.4	0.2	0.0	0.2	0.2	0.4	0.2	0.0	0.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.2	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.4	0.2	0.0	0.3	0.0	0.0	0.3	0.0
0.2	0.0	0.3	0.2	0.3	0.2	0.3	0.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.3	0.0
0.0	0.3	0.0	0.0	0.3	0.5	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

of palynomorphs (4th section continued)

number

120	123	124	125	127	129	131	132	134	136	138	142	143	144	146	148
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.2	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
1.0	0.0	0.6	0.2	0.0	0.0	0.0	0.2	0.3	1.8	2.0	0.3	0.0	0.0	0.0	0.3
0.0	0.0	0.0	0.0	0.2	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	1.0
0.0	0.7	0.4	0.0	0.0	0.5	0.8	0.5	0.3	1.0	0.3	0.5	0.0	0.7	0.0	0.0
0.2	0.0	0.2	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.5	0.5	0.0
0.0	0.0	1.0	0.0	0.0	0.3	0.5	0.7	0.0	0.0	0.8	0.0	0.0	0.2	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.0	0.3	0.8	0.8	0.0	0.0	0.0	0.2
0.0	0.0	0.2	0.2	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.2	0.0	0.0	0.0	0.3	0.5	0.2	0.0	0.8	0.0	0.5	0.0	0.5	0.3	0.6
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.2	0.2	0.0	0.2	1.1	0.0	0.2	0.0	0.0	0.0	0.8	0.5	0.0	0.0	0.0
0.0	0.5	0.0	0.0	0.0	0.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
0.2	0.0	0.0	0.0	0.0	0.3	0.3	0.0	0.3	0.0	0.5	0.0	0.0	0.0	0.3	0.3
0.0	0.0	0.0	0.2	0.0	0.0	0.8	0.2	0.8	0.3	0.0	0.5	0.0	0.0	0.0	0.0
0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.5	0.6	0.2	0.0	0.0	0.8	0.2	0.0	0.0	0.0	0.0	0.3	0.5	0.0	0.6
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.4	0.2	0.2	0.2	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
0.6	0.0	0.0	0.5	0.2	0.5	0.5	0.2	0.6	0.0	1.8	0.3	0.0	0.2	0.5	0.0
0.0	0.0	0.4	0.0	0.5	0.0	0.8	0.0	0.8	0.5	0.0	0.0	0.0	0.5	0.0	0.0
0.0	0.2	1.0	0.0	0.5	0.3	0.0	0.5	0.3	0.0	0.0	1.4	0.0	0.7	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	1.2	0.2	0.5	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.3
0.0	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	1.3
0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.2	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 1. Number and percentage

Taxa	K6	K4	K2	K1	1	3	9	11	15
Triplanosporites medius	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
T. rugulatus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Verrucingulatisporites formosensis	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
V. taiwanensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Striamonoletes taiwanensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Bacutriletes desobaculus	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sphaerina taiwanensis	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
Deltoidospora taiwanensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Saxosporis taiwanensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Verrucosisporites taiwanensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rudolphisporis taiwanensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Polypodiidites taiwanensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pterisporis taiwanensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P. concavus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zonomonoletes taiwanensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Conisporites taiwanensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Verrucopunctasporites taiwanensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Microreticulatisporites taiwanensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Taxa number of pteridophytes	15	21	17	12	18	25	19	17	21
Sum of pteridophytous percentage	11.5	20.6	13.5	19.7	14.4	15.3	19.8	21.7	18.1
Sum of taxa	61	65	62	41	63	70	61	57	62
Total number of palynomorphs identified	358	436	459	244	452	379	440	355	393
Neotriangulipollis taiwanensis	0	0	0	0	0	0	0	0	0
Riestedtipollis polycolpites	0	0	0	0	0	0	0	0	0
Classopollis taiwanensis	2	0	0	0	1	4	0	1	0
Podocarpidites magnus	0	0	0	0	0	0	0	0	0
Monogemmites taiwanensis	0	0	0	0	0	0	0	0	0
M. formosensis	0	0	0	0	0	0	0	0	0
Sharbysporites taiwanensis	0	0	0	0	0	0	0	0	1
Lycopodiacidites infragranulatus	0	0	0	0	0	0	0	0	0
Concavisporites colliculosus	0	0	0	0	0	0	0	0	0
Semiretisporis taiwanensis	0	0	0	0	0	0	0	0	0
Appendicisporites taiwanensis	0	0	0	0	0	0	0	0	0
Schizosporis taiwanensis	0	3	3	0	1	0	0	0	1
Perotriletes reticulatus	0	0	0	0	0	0	0	0	0
Unidentified monocots	15	3	3	20	3	6	2	10	8
Unidentified moss	2	3	2	0	8	9	2	1	4
Unidentified crumpled (1-3 colp(or)ate)	44	20	29	16	25	31	29	22	34
Unidentified abrased	21	16	22	37	42	48	35	30	32
Dinoflagellates	1	2	1	2	0	0	4	3	2
Inner test of foramiferae	4	1	0	0	1	9	2	0	2

of palynomorphs (5th section continued)

Sample number															
21	23	25	31	35	39	42	47	49	53	64	68	69	71	74	75
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	20	17	15	12	9	18	14	17	34	25	17	22	18	28	19
24.1	21.4	17.6	13.0	12.5	11.8	12.4	14.9	19.9	27.5	20.0	13.0	18.0	16.9	27.5	14.0
58	64	65	62	60	51	59	63	48	76	75	65	56	56	77	66
365	444	448	430	359	364	394	449	312	448	404	468	323	385	480	449
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	2	0	0	0	0	2	4	0	0	0	0	0	0	0
0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	1	1	0	0	0	3	0	0	0	0	0	0	0	1	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	2	7	3	6	4	21	9	6	4	14	4	11	6	6	8
5	1	2	5	10	3	19	12	10	13	18	20	18	13	10	27
31	20	17	15	21	13	16	17	20	16	14	27	18	20	24	21
30	27	19	10	15	31	19	35	38	31	27	25	35	25	22	18
0	3	0	0	2	6	0	1	1	0	19	5	3	6	1	0
1	1	0	1	2	0	1	2	0	1	4	1	0	0	0	2

Table 1. Number and percentage

Sample															
79	81	83	85	89	91	94	97	101	105	106	108	112	115	116	118
0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.0
0.0	0.0	0.0	0.2	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	27	21	26	22	25	24	24	22	20	18	20	24	22	15	20
18.3	20.4	18.2	26.9	26.5	21.6	19.3	19.0	15.6	13.8	11.3	18.3	16.0	18.5	18.4	15.4
77	71	59	72	65	67	65	72	69	65	66	62	80	75	58	66
405	392	362	469	362	407	362	494	456	448	467	579	530	480	343	422
0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
0	0	0	0	0	0	0	2	0	1	0	0	2	1	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
7	6	9	7	8	9	14	11	7	10	13	15	4	15	7	16
20	21	22	35	9	22	17	23	59	14	30	27	24	24	10	17
18	16	18	15	5	18	8	18	16	7	23	15	23	19	19	19
38	27	19	32	21	19	15	21	20	21	38	45	41	42	45	40
2	1	0	3	1	1	5	2	0	5	2	5	6	0	2	3
0	0	2	0	0	3	2	0	0	0	0	2	1	2	0	7

of palynomorphs (5th section continued)

number															
120	123	124	125	127	129	131	132	134	136	138	142	143	144	146	148
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.2	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
20	17	22	17	24	19	22	24	14	14	12	22	14	20	14	18
14.8	13.1	15.3	15.4	14.9	18.0	21.1	19.6	16.8	18.6	18.9	21.5	16.2	19.6	10.0	15.8
69	61	70	68	65	63	63	63	53	42	49	70	54	58	52	55
514	434	491	421	409	372	388	404	357	382	392	368	383	414	390	316
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	1	0	0	0	4	0	0	0	0	0	1	0	0	0	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
5	5	12	7	10	8	12	8	2	10	3	7	4	1	2	1
26	22	15	16	31	17	19	17	20	7	9	19	12	23	24	7
13	25	16	10	16	20	21	30	20	20	25	25	37	35	43	26
35	55	56	53	58	36	65	71	68	72	26	50	68	57	27	29
0	0	0	0	3	6	0	4	2	3	2	1	0	0	0	2
0	3	4	0	2	9	0	21	15	12	5	7	3	9	6	2

Table 2. Percentage, number of taxa and new name of pteridophytes and bryophytes, gymnosperms and angiosperms, found in Yunsuichi section

	Percentage	Taxa			New name			
		Genus	Species	Variety	Genus	Species	New record	New combination
Pteridophytes and bryophytes	17.6	53	85	3	1	25	2	1
Gymnosperms	31.5	13	30			4	1	
Angiosperms	50.8	67	76		5	23	2	1
Total		133	191	3	6	52	5	2

Table 3. Comparison of angiospermous fossil pollen records in Taiwan and the records in Muller's review in the year of 1981

Family name (first record)	Taiwan		Other areas	
	Genus name	Sample number	Genus name	Time and place of records
Cruciferae (U. Miocene)	*Arabis*	143	—	U. Miocene France
Labiatae (U. Miocene)	*Salvia*	120	*Salvia*	U. Miocene Alaska
Loganiaceae	*Fagraea*	125	—	—
Malvaceae (U. Eocene)	*Abutilon*	116	*Hibiscus*	Miocene Australia
Onagraceae (L. Miocene)	*Trapa* ?	25	*Trapa* ?	Pliocene Austria
Plantaginaceae (U. Miocene)	*Plantago*	127	*Plantago*	U. Miocene Spain, Germany
Rutaceae (Pliocene)	*Murraya*	79	*Phellodendron*	Pliocene W. Europe
Valeriaceae (Pliocene)	*Patrinia*	64	—	—

CHECKLIST

Ⅰ. Alete Spores 無裂溝孢綱

1. ***Conisporites*** C. L. Huang & T. C. Huang 錐突孢屬
   C. taiwanensis C. L. Huang & T. C. Huang 臺灣錐突孢 Pl. 1: 1
2. ***Corrusporis*** Krutzsch 1967 擂凸孢屬
   C. taiwanensis C. L. Huang & T. C. Huang 臺灣擂凸孢 Pl. 1: 2-6

Ⅱ. Monolete Spores 單裂溝孢綱

3. ***Echinosporis*** Krutzsch 1967 長刺單裂孢屬
   E. taiwanensis Huang 臺灣長刺單裂孢 Pl. 15: 1-2
4. ***Extrapunctatosporis*** Krutzsch 1959 外孔紋單裂孢屬
   E. taiwanensis Huang 臺灣外孔紋單裂孢 Pl. 15: 7-8
5. ***Gemmamonoletes*** Peirce 1961 顆粒紋單裂孢屬
   (1) ***G. formosensis*** Huang 寶島顆粒紋單裂孢 Pl. 15: 5-6
   (2) ***G. oblongo-lunatus*** Huang 長月狀顆粒紋單裂孢 Pl. 15: 3-4
6. ***Gemmatosporis*** Krutzsch 1959 短棒紋單裂孢屬
   (1) ***G. lato-apertus*** Huang 濶裂短棒紋單裂孢 Pl. 17: 3-4
   (2) ***G. taiwanensis*** Huang 臺灣短棒紋單裂孢 Pl. 17: 5-8

7. *Intrapunctosporis* Krutzsh 1967 內孔紋單裂孢屬
   I. taiwanensis Huang 臺灣內孔紋單裂孢
8. *Laevigatosporites* Ibrahim 1933 平滑單裂孢屬
   (1) *L. gracilis* Wilson & Webster 細小形平滑單裂孢 Pl. 15: 13
   (2) *L. tenui-lunatus* Huang 薄月形平滑單裂孢
9. *Latosporites* Potonie & Kremp 1954 寬單裂孢屬
   L. taiwanensis Huang 臺灣寬單裂孢
10. *Lunulasporites* Wilson 1962 月狀單裂孢屬
    L. taiwanensis Huang 臺灣月狀單裂孢
11. *Perinomonoletes* Krutzsch 1967 外膜單裂孢屬
    (1) *P. granulatus* Huang 顆粒紋外膜單裂孢 Pl. 15: 9-11
    (2) *P. lato-reticulatus* Huang 巨網紋外膜單裂孢 Pl. 16: 3-4
    (3) *P. lato-reticulatus* var. *punctatus* Huang 穿孔巨網紋外膜單裂孢 Pl. 15: 12
    (4) *P. reticulatus* var. *scabrato-marginatus* Huang 細波緣網紋外膜單裂孢 Pl. 16: 1-2
12. *Polypodiidites* Ross 1949 牛圓孢屬
    P. taiwanensis Huang 臺灣牛圓孢
13. *Schizaeoisporites* Potonie 1951 *ex* Delcourt & Sprument 1935 莎草裂孢屬
    S. taiwanensis Huang 臺灣莎草裂孢 Pl. 17: 1-2
14. *Striamonoletes* Mathur 1966 條紋單裂孢屬
    S. digitatus C.L. Huang & T.C. Huang 臺灣條紋單裂孢 Pl. 2: 1-2
15. *Verrucatosporites* Pflug & Thomson 1953 牛圓紋單裂孢屬
    (1) *V. balticoides* Huang 波羅的海牛圓紋單裂孢 Pl. 16: 5-6
    (2) *V. balticoides* var. *minor* Huang 小波羅的海牛圓紋單裂孢 Pl. 16: 7-9
    (3) *V. lunatus* Huang 月狀牛圓紋單裂孢 Pl. 16: 10
    (4) *V. reniformis* Huang 腎形牛圓單裂孢 Pl. 16: 11-12
16. *Zonomonoletes* Naunova 1939 *ex* Bolhhovitina 1933 環壁單裂孢屬
    Z. taiwanensis Huang 臺灣環壁單裂孢

Ⅲ. Triletes Spores 參裂溝孢綱

17. *Anthocerisporis* Krutzsch 1963 角蘚孢屬
    (1) *A. formosensis* T.C. Huang & C.H. Tsou 寶島角蘚孢 Pl. 2: 9-14
    (2) *A. reticulatus* T.C. Huang & C.H. Tsou 網紋角蘚孢 Pl. 3: 1-3
    (3) *A. taiwanensis* C.L. Huang & T.C. Huang 臺灣角蘚孢 Pl. 2: 6-8
18. *Appendicisporites* Weyland & Krieger 1953 長角三裂孢屬
    A. taiwanensis C.L. Huang & T.C. Huang 臺灣長角三裂孢 Pl. 3: 6-7
19. *Bacutriletes* Potonie 1956 圓柱紋徑三裂孢屬
    B. desobaculus Huang 臺灣圓柱紋徑三裂孢
20. *Cibotiumsporites* Rouse 1957 金狗毛孢屬
    (1) *C. barometz* C.L. Huang & T.C. Huang 巴羅梅茲金狗毛孢 Pl. 3: 4-5
    (2) *C. cumingus* Huang 菲律賓金狗毛孢 Pl. 18: 1-2
21. *Cicatricosisporites* Potonie & Gelletich 1933 環肋孢屬
    (1) *C. australiensis* (Cookson) Potonie 澳洲環肋孢 Pl. 18: 6
    (2) *C. formosensis* (Huang) C.L. Huang & T.C. Huang 寶島環肋孢 Pl. 4: 1-5
    (3) *C. taiwanensis* Huang 臺灣環肋孢 Pl. 18: 5
22. *Cingulatisporites* Thomson in Thomson & Pflug 1953 整環孢屬
    C. taiwanensis Huang 臺灣整環孢 Pl. 18: 3-4
23. *Concavisporites* Pflug in Thomson & Pflug 1953凹邊孢屬
    C. colliculosus C.L. Huang & T.C. Huang 脊凸凹邊孢 Pl. 4: 6-7
24. *Concavitriletes*'Krutzsch 1959 邊凹三叉裂孢屬
    C. taiwanensis Huang 臺灣邊凹三叉裂孢
25. *Crassoretitriletes* Germeraad, Hopping & Muller 1968厚壁三叉裂孢屬
    C. vanraadshooveni G.H.M. 泛厚壁三叉裂孢 Pl. 19: 1-2

26. *Deltoidospora* Miner 1935 三角孢屬
D. taiwanensis Huang 臺灣三角孢
27. *Foveotriletes* Potonie 1956 孔紋三叉裂孢屬
(1) *F. formosensis* Shaw & Huang 寶島孔紋三叉裂孢 Pl. 19: 3-4
(2) *F. serratus* Huang 石松孔紋三叉裂孢 Pl. 18: 7-9
28. *Gemmatotriletes* Huang 1978 短棒紋三叉裂孢屬
G. formosensis Shaw & Huang 臺灣短棒紋三叉裂孢
29. *Gleicheniidites* Ross 1949, Krutzsch 1949 類裏白孢屬
G. taiwanensis Huang 臺灣類裏白孢
30. *Granulatisporites* Shaw & Huang 1984 顆粒紋三叉裂孢屬
G. formosensis Shaw & Huang 寶島顆粒紋三叉裂孢 Pl. 19: 5
31. *Leiotriletes* Naumova 1939 *ex* Ishchenlo 1952 平滑徑三裂孢 屬
(1) *L. ellipticus* Huang 橢圓平滑徑三裂孢
(2) *L. magnus* C. L. Huang & T. C. Huang 大平滑徑三裂孢 Pl. 3: 8-9
(3) *L. sphaerotriangulus* (Loose) Potonie & Kremp 圓三角形平滑徑三裂孢
(4) *L. taiwanensis* Huang 臺灣平滑徑三裂孢
32. *Lycopodiacidites* Couper 1953 石松孢屬
L. infragranulatus Mädler 下顆粒紋石松孢 Pl. 4: 8-10
33. *Magnastriatites* Germeraad, Hopping & Muller 1968 水蕨孢屬
M. grandiosus (Kedves et Solé de Porta) Duenas 1980 侯瓦第水蕨孢 Pl. 20: 1-10
34. *Microreticulatisporites* Knox 1950 小網紋三裂孢 屬
M. taiwanensis L. C. Huang & T. C. Huang 臺灣小網紋三裂孢 Pl. 5: 11-12
35. *Perotriletes* (Erdtman 1945, 1947) *ex* couper 1953 外膜三叉裂孢 屬
P. reticulatus Hsaw & Huang 網紋外膜三叉裂孢 Pl. 23: 7
36. *Polypodiaceoisporites* Potonié 1951 鳳尾蕨孢屬
(1) *P. baculatus* C. L. Huang & T. C. Huang 棒紋鳳尾蕨孢 Pl. 5: 1-5
(2) *P. dactylinus* Huang 掌鳳尾蕨孢
(3) *P. emarginatus* Huang 凹角鳳尾蕨孢 Pl. 19: 8-10
(4) *P. ensiformis* C. L. Huang & T. C. Huang 筒葉鳳尾蕨孢 Pl. 6: 1-4
(5) *P. gracilimus* Nagy 弱委鳳尾蕨孢
(6) *P. intrabalticus* Huang 內波羅的海鳳尾蕨孢
(7) *P. intragigantibalticus* Huang 內大波羅的海鳳尾蕨孢
(8) *P. nipponicus* C. L. Huang & T. C. Huang 日本鳳尾蕨孢 Pl. 6: 5-6
(9) *P. setuloso-costulatus* Huang 粗刺鳳尾蕨孢 Pl. 21: 5-6
(10) *P. venustus* Huang 爪哇鳳尾蕨孢 Pl. 21: 1-4
(11) *P. wallichianus* Huang 瓦氏鳳尾蕨孢 Pl. 19: 6-7
37. *Pterisporis* Huang 1978 類鳳尾蕨孢屬
(1) *P. concavus* Huang 凹邊類鳳尾蕨孢 Pl. 21: 7-9
(2) *P. taiwanensis* Huang 臺灣類鳳尾蕨孢 Pl. 21: 10-11
38. *Punctatisporites* Ibrahim 1933 穿孔紋孢屬
P. formosensis Huang & Huang 寶島穿孔紋孢 Pl. 6: 7-10
39. *Retitriletes* Pierce 1961 厚網紋徑三裂孢屬
R. taiwanensis Huang 臺灣厚網紋徑三裂孢 Pl. 21: 12-16
40. *Rudolphisporis* Krutzsch 1963 雷道夫角瘤孢屬
R. taiwanensis C. L. Huang & T. C. Huang 臺灣雷道夫角瘤孢 Pl. 7: 1-2
41. *Saxosporis* Krutzsoh 1963 劍刺孢蕨屬
S. taiwanensis C. L. Huang & T. C. Huang 臺灣劍刺孢 Pl. 7: 7-9
42. *Semiretisporis* Reinhardt 1962 半網紋孢屬
S. taiwanensis C. L. Huang & T. C. Huang 臺灣半網紋孢 Pl. 7: 10-12
43. *Skarbysporites* Mädler 1964 環脊凸厚壁孢屬
S. taiwanensis C. L. Huang & T. C. Huang 臺灣環脊凸厚壁孢 Pl. 8: 1-3
44. *Sphaerina* Maljavkina 1949 *ex* Delcourt & Sprumont 1959 突刺孢屬
S. taiwanensis C. L. Huang & T. C. Huang 臺灣突刺孢 Pl. 2: 3-5

45. *Sphagnumsporites* Rattz (1937) 1938 *ex* Potonié 1956 水苔孢屬
    (1) *S. formosensis* C. L. Huang & T. C. Huang 寶島水苔孢 Pl. 7: 5-6
    (2) *S. stereoides* (Pot & Ven) Raatz 立體狀水苔孢 Pl. 7: 3-4
46. *Toricingulatisporites* Simonesies 1964 向心面脊緣孢屬
    T. taiwanensis Huang 臺灣向心面極整環孢 Pl. 22: 1-2
47. *Toroisporis* Krutzsch 1959 向心面極三叉孢屬
    T. taiwanensis Huang 臺灣向心面極三叉裂孢 Pl. 22: 3-12
48. *Triplanosporites* Pflug in Thomson & Pflug 1952 楊桃形三叉裂孢屬
    (1) *T. medius* Shaw & Huang 中楊桃形三叉裂孢 Pl. 23: 1-3
    (2) *T. minor* Shaw & Huang 小楊桃形三叉裂孢 Pl. 23: 4-6
    (3) *T. rugulatus* C. L. Huang & T. C. Huang 皺條紋楊桃形三叉裂孢 Pl. 8: 4-6
49. *Verrucingulatisporites* Kedves 1961a 牛圍紋整環三叉裂孢屬
    (1) *V. baculatus* C. L. Huang & T. C. Huang 圍柱紋三叉裂孢 Pl. 5: 6-7
    (5) *V. formosensis* C. L. Huang & T. C. Huang 寶島牛圍紋整環三叉裂孢 Pl. 8: 7-8
    (3) *V. taiwanensis* Huang 臺灣牛圍紋三叉裂孢
50. *Verrucopunctasporites* Kar, Kieser & Jain 1973 牛圍紋鈍角孢屬
    V. taiwanensis C. L. Huang & T. C. Huang 臺灣牛圍紋鈍角孢 Pl. 5: 8-10
51. *Verrucosisporites* Ibrahim 1933 牛圍紋三叉裂孢屬
    V. taiwanensis Huang 臺灣牛圍紋三叉裂孢 Pl. 23: 8-11

Ⅳ. Incertae 未定孢綱

52. *Monogemmites* Krutzsch 1970 雛刺單口孢粉屬
    (1) *M. formosensis* C. L. Huang & T. C. Huang 寶島雛刺單口孢粉 Pl. 8: 9-11
    (2) *M. taiwanensis* C. L. Huang & T. C. Huang 臺灣雛刺單口孢粉 Pl. 8: 12-15
53. *Schizosporis* Cookson & Dettmann 1959 牛裂圍孢粉屬
    S. taiwanensis Huang 臺灣牛裂圍孢粉

Ⅴ. Gymnospermous pollen grains

1. *Cycadopites* Wodehouse 1933 蘇鐵狀粉屬
    (1) *C. ellipticus* Huang 橢圓形蘇鐵狀粉 Pl. 24: 1
    (2) *C. gracilis* Krutzsch 常見蘇鐵狀粉 Pl. 24: 2-3
2. *Sequoiapollenites* Thiergart 1937 世界爺粉屬
    S. taiwanensis Huang 臺灣世界爺粉
3. *Classopollis* Pflug 1953 內環粉屬
    C. taiwanensis Huang 臺灣內環粉 Pl. 24: 4-5
4. *Abiespollenites* Thiergart in Raatz (1937) 1938 冷杉粉屬
    (1) *A. formosensis* Huang 臺灣冷杉粉 Pl. 24: 6-9
    (2) *A. oblongus* Huang 橫長體冷杉粉 Pl. 24: 10-11
5. *Hesperopeucepollenites* Huang 1979 翼鐵杉粉屬
    H. pattoniana Huang 柏特翼鐵杉粉
6. *Keteleeriaepollenites* Nagy 1969 油杉粉屬
    K. taiwanensis Huang 臺灣油杉粉 Pl. 25: 1-3
7. *Longicorpuspollenites* Huang 1979 縱長體杉粉屬
    L. taiwanensis Huang 臺灣縱長體杉粉 Pl. 25: 4-7
8. *Piceapollis* Krutzsch 1971 雲杉粉屬
    P. acutosaceatus Huang 尖囊雲杉粉 Pl. 25: 8-11
9. *Pityosporites* Seward 1914 松粉屬
    (1) *P. acutus* Huang 銳體松粉 Pl. 26: 5-6
    (2) *P. massoniana* Huang 馬尾松粉
    (3) *P. morrisonicola* Huang 玉山松粉
    (4) *P. oblongus* Huang 橫長體松粉 Pl. 26: 1-2
    (5) *P. scabratus* Huang 波紋體松粉 Pl. 26: 3-4
    (6) *P. triangulatus* Huang 三角體松粉
    (7) *P. zonalatatus* Huang 環翼松粉 Pl. 26: 7-10

10. *Zonalapollenites* Pflug in Thomson & Pflug 1953 環翼纖杉粉屬
    (1) *Z. chinensis* Huang 中國環翼纖杉粉 Pl. 27: 1-10
    (2) *Z. taiwanensis* Huang 臺灣環翼纖杉粉 Pl. 28: 1-4
11. *Dacrydiumites* Cookson 1955 *ex* Harris 1965 陸均松粉屬
    (1) *D. magnus* C. L. Huang & T. C. Huang 巨型陸均松粉 Pl. 9: 1-2
    (2) *D. taiwanensis* Huang 臺灣陸均松粉 Pl. 28: 5-8, Pl. 29: 1-4
12. *Podocarpidites* Cookson *ex* Couper 1953 羅漢松粉屬
    (1) *P. beugii* Huang 波義羅漢松粉 Pl. 29: 5-7
    (2) *P. conjunctus* C. L. Huang & T. C. Huang 連結羅漢松粉 Pl. 9: 3-6
    (3) *P. magnus* C. L. Huang & T. C. Huang 巨型羅漢松粉 Pl. 10: 3-5
    (4) *P. taiwanensis* Huang 臺灣羅漢松粉 Pl. 29: 8-10, Pl. 30: 1-4
13. *Ephedripites* Seward 1914 麻黃粉屬
    (1) *E. ellipticus* Huang 橢圓麻黃粉 Pl. 30: 5-8
    (2) *E. kuanyinshanensis* Huang & Chaw 觀音山麻黃粉 Pl. 30: 11
    (3) *E. multus* C. L. Huang & T. C. Huang 多肋麻黃粉 Pl. 10: 1-2
    (4) *E. tertiarius* Krutzsch 第三紀麻黃粉 Pl. 9: 7-10
    (5) *E. taiwanensis* Huang 臺灣麻黃粉 Pl. 30: 9-10

VI. Angiospermous pollen grains

1. *Tricolpopollenites* Pflug & Thomson in Thomson & Pflug 1953 (Aizoaceae) 三溝粉屬
    (1) *T. ellipticus* Huang 橢圓三溝粉 Pl. 32: 1-2
    (2) *T. elongtus* Huang 長型三溝粉 Pl. 32: 3-4
2. *Trachelospermumpollenites* C. L. Huang & T. C. Huang (Apocynaceae) 絡石粉屬
    T. taiwanensis C. L. Huang & T. C. Huang 臺灣絡石粉 Pl. 10: 6-10
3. *Ilexpollenites* Thiergart 1937 *ex* Potonié 1960 (Aquifoliaceae) 冬青粉屬
    (1) *I. asprella* Huang 糙稱冬青粉 Pl. 32: 5-8
    (2) *I. kusanoi* Huang 粗紋冬青粉 Pl. 32: 9-10
    (3) *I. minor* C. L. Huang & T. C. Huang 小型冬青粉 Pl. 10: 11-13
4. *Alnusalispollenites* Huang 1980 (Betulaceae) 三孔檍木粉屬
    A. taiwanensis Huang 三孔檍木粉 Pl. 32: 11-12
5. *Carpinipites* Srivastava 1966 (Betulaceae) 千金榿粉屬
    C. taiwanensis Huang 臺灣千金榿粉
6. *Myricaceoipollenites* Potonié 1951 *ex* Potonié 1960 (Betulaceae) 楊木類粉屬
    M. megagranifer (Pot.) Pot. 楊木類粉 Pl. 32: 21-22
7. *Alnipollenites* Potonié 1932 *ex* Potonié 1960 檍木粉屬
    A. formosensis)Huang) Huang (Betulaceae) 臺灣檍木粉 Pl. 32: 15-18
8. *Triporopollenites* Pflug & Thomson in Thomson & Pflug 1953 (Betulaceae) 三孔粉屬
    T. coryloides Pflug 變形榛木粉
9. *Trivestibulopollenites* Pflug in Thomson Pflug 1953 (Betulaceae) 三腔粉屬
    T. taiwanensis Huang 臺灣三腔粉 Pl. 32: 13-14
10. *Loniceraepollis* Krutzsch 1962 (Caprifoliaceae) 金銀花粉屬
    L. japonicus Huang 金銀花粉 Pl. 33: 1-2
11. *Chenopodiopollis* Krutzsch 1966 (Chenopodiaceae) 藜粉屬
    C. taiwanensis Huang 臺灣藜粉 Pl. 33: 3-6
12. *Ageratumpollenites* Huang 1980 (Compositae) 霍香薊粉屬
    A. taiwanensis Huang 臺灣霍香薊粉
13. *Artemisiaepollenites* Nagy 1969 (Compositae) 茵陳蒿粉屬
    A. annus C. L. Huang & T. C. Huang 茵陳蒿粉 Pl. 10: 14-15
14. *Dichrocephalapollenites* Huang 1980 (Compositae) 豕草粉屬
    D. taiwanensis Huang 臺灣豕草粉 Pl. 33: 7-9
15. *Hemisteptapollenites* C. L. Huang & T. C. Hnang (Compositae) 泥胡菜粉屬
    H. hyratus C. L. Huang & T. C. Huang 泥胡菜粉 Pl. 11: 1

16. *Cichoreacidites* Sah 1967 (Dec.) (Compositae) 萵苣粉屬
C. taiwanensis C. L. Huang & T. C. Huang 臺灣萵苣粉 Pl. 11: 2-3
17. *Tricolpopollenites* Pflug & Thomson in Thomson & Pflug 1953 (Cruciferae) 芥菜粉屬
T. morrisonensis C. L. Huang & T. C. Huang 玉山芥菜粉 Pl. 10: 16-18
18. *Daphniphyllumpollenits* Huang 1980 (Daphniphyllaceae) 交讓木粉屬
D. oldhamii Huang 交讓木粉
19. *Slowakipollis* Krutzsch 1962a (Elaeagnaceae) 胡頹子粉屬
S. taiwanensis (T. C. Huang) C. L. Huang & T. C. Huang 臺灣胡頹子粉 Pl. 11: 4-6
20. *Elaeocarpollenites* Huang 1980 (Elaeocarpaceae) 杜英粉屬
E. taiwanensis Huang 臺灣杜英粉 Pl. 33: 10-12
21. *Tricolporopollenites* Pflug & Thomson in Thomson & Pflug 1953 (Euphorbiaceae) 三溝孔粉屬
T. taiwanensis Huang 臺灣三溝孔粉 Pl. 33: 13-16
22. *Wilsonipites* Srivastava 1969 (Euphorbiaceae) 蓖麻粉屬
W. communis C. L. Huang & T. C. Huang 蓖麻粉 Pl. 11: 7-9
23. *Tricolporopollenites* Pflug & Thomson in Thomson & Pflug (Fagaceae) 梭力粉屬
(1) *T. amygdalifolius* Huang 梭力粉 Pl. 33: 17-19
(2) *T. minus* Huang 細體梭力粉 Pl. 33: 20-21
(3) *T. perprolatus* Huang 長體梭力粉 Pl. 33: 22-23
(4) *T. scabratus* Huang 波體梭力粉
(5) *T. uraiensis* Huang 烏來柯粉 Pl. 33: 24-25
24. *Peripollenites* Pflug & Thomson in Thomson & Pflug 1953 (Hamamelidaceae 楓香粉屬
(1) *P. formosensis* Huang 臺灣楓香粉 Pl. 34: 1-3
(2) *P. minus* Huang 微體楓香粉
25. *Caryapollenites* Raatz (1973) 1938 *ex* Potonié 1960 (Juglandaceae) 山核桃粉屬
C. taiwanensis C. L. Huang & T. C. Huang 臺灣山核桃粉 Pl. 11: 14-18
26. *Engelhardtioipollenites* Potonié 1951 *ex* Potonié 1960 (Juglandaceae) 黃杞粉屬
E. taiwanensis C. L. Huang & T. C. Huang 臺灣黃杞粉 Pl. 11: 10-13
27. *Juglanspollenites* Raatz 1939 (Juglandaceae) 胡桃粉屬
J. taiwanensis Huang 臺灣胡桃粉
28. *Polyatriopollenites* Pflug 1953 (Juglandaceae) 楓楊粉屬
P. taiwanensis Huang 臺灣楓楊粉 Pl. 34: 4-8
29. *Paraphlomipollenites* C. L. Huang & T. C. Huang (Labiatae) 鬱子草粉屬
P. taiwanensis C. L. Huang & T. C. Huang 臺灣鬱子草粉 Pl. 13: 4-6
30. *Retihexacolpites* Mathur 1966 (Labiatae) 鼠尾草粉屬
R. taiwanensis C. L. Huang & T. C. Huang 臺灣鼠尾草粉 Pl. 12: 1-3
31. *Margocolporites* Ramanujam 1966 *ex* Srivastava 1969 (Leguminosae) 苦木粉屬
M. vanwijhei Germeraed Hopping & Muller 苦木粉 Pl. 34: 9-10
32. *Tricolporopollenites* Pflug & Thomson in Thomson & Pflug (Leguminosae) 決明粉屬
T. miocenus Huang 決明粉
33. *Assamialetes* C. L. Huang & T. C. Huang (Loganiaceae) 灰莉粉屬
A. taiwanensis C. L. Huang & T. C. Huang 臺灣灰莉粉 Pl. 12: 4-6
34. *Magnolipollis* Krutzsch 1970 (Magnoliaceae) 木蘭粉屬
(1) *M. longiformis* Huang 長型木蘭粉
(2) *M. medius* Huang 中型木蘭粉
(3) *M. taiwanensis* Huang 臺灣木蘭粉
35. *Malvacearumpollis* Nagy 1962 (Malvaceae) 錦葵粉屬
M. taiwanensis C. L. Huang & T. C. Huang 臺灣錦葵粉 Pl. 12: 12-14
36. *Pericampyluspollenites* Huang 1980 (Menispermaceae) 蓬萊藤粉屬
P. taiwanensis Huang 臺灣蓬萊藤粉
37. *Triatriopollenites* Pflug in Thomson & Pflug 1953 (Myricaceae) 楊梅粉屬
T. taiwanensis Huang 臺灣楊梅粉 Pl. 32: 19-20
38. *Myrtaceidites* Cookson & Pike 1954 (Myrtaceae) 桃金孃粉屬
M. taiwanensis C. L. Huang & T. C. Huang 臺灣桃金孃粉 Pl. 12: 7-11

39. *Corsinipollenites* Nakoman 1965 (Onagraceae) 柄葉菜粉屬
C. peploides Huang 丁香蓼粉
30. *Sporotrapoidites* Klaus 1954 (Onagraceae) 擬菱角粉屬
S. illingensis Kl. 依林擬菱角粉 Pl. 13: 1-3
41. *Plantaginacearumpollis* Nagy 1963c (Plantaginaceae) 車前草粉屬
P. formosensis C. L. Huang & T. C. Huang 寶島車前草粉 Pl. 13: 7-9
42. *Margoaperturates* C. L. Hnuag & T. C. Huang (Polygonaceae) 厚口簍粉屬
(1) *M. hypoleucus* C. L. Huang & T. C. Huang 裏白厚口簍粉 Pl. 13: 14-17
(2) *M. taiwanensis* C. L. Huang & T. C. Huang 臺灣蛇根草粉 Pl. 13: 10-13
43. *Polygonacidites* Sah & Dutta 1968 (Polygonaceae) 蓼粉屬
(1) *P. densoreticulatus* Huang 突網蓼粉 Pl. 34: 15-17
(2) *P. minus* Huang 微證蓼粉 Pl. 34: 11-12
(3) *P. vulgaris* Huang 常見蓼粉 Pl. 34: 13-14
44. *Rubuspollenites* Huang 1980 (Rosaceae) 懸鉤子粉屬
R. formosensis Huang 臺灣懸鉤子粉
45. *Gardeniapites* Huang 1978 (Rubiaceae) 梔子粉屬
G. taiwanensis Huang 臺灣梔子粉 Pl. 35: 1-2
46. *Margoaperturates* C. L. Huang & T. C. Huang (Rubiaceae) 厚口簍粉屬
M. taiwanensis C. L. Huang & T. C. Huang 蛇根草粉 Pl. 13: 10-13
47. *Gemmatricolporites* Leidelmeyer 1966 (Rutaceae) 柑橘粉屬
G. pedunculata Huang 山柑粉
48. *Rutaceoipollenites* Sun 1978 (Rutaceae) 芸香粉屬
R. taiwanensis C. L. Huang & T. C. Huang 臺灣芸香粉 Pl. 14: 1-2
49. *Tricolporopollenites* Pflug & Thomson in Thomson & Pflug 1953 (Saxifragaceae) 繡球粉屬
T. asper C. L. Huang & T. C. Huang 繡球粉 Pl. 14: 3-6
50. *Symplocacites* Mtchedlishvili 1961 in Samollovich & Mtchedlishvili (Symplocaceae) 灰木粉屬
(1) *S. caudata* Huang 尾葉灰木粉 Pl. 35: 3-5
(2) *S. modesta* Huang 小葉灰木粉 Pl. 35: 6-7
51. *Tiliaepollenites* Potonié 1931 (Tiliaceae) 田麻粉屬
T. taiwanensis Huang 臺灣田麻粉 Pl. 35: 12-17, Pl. 36: 1-3
52. *Ulmipollenites* Wolff 1934 (Ulmaceae) 榆粉屬
U. taiwanensis Huang 臺灣榆粉 Pl. 36: 4-9
53. *Zelkovaepollenites* Nagy 1969 (Ulmaceae) 雞油粉屬
Z. taiwanensis Huang 雞油粉 Pl. 36: 10-13
54. *Patriniapollenites* C. L. Huang & T. C. Huang (Valerianaceae) 敗醬粉屬
P. taiwanensis C. L. Huang & T. C. Huang 臺灣敗醬粉 Pl. 14: 7-10
55. *Tricolporopollenites* Pflug & Thomson in Thomson & Pflug 1953 (Vitaceae) 虎葛粉屬
T. repens Huang 虎葛粉 Pl. 35: 8-11
56. *Graminidites* Cookson 1974 *ex* Potonié 1960 (Gramineae) 禾草粉屬
G. glabratus Huang 光證禾草粉 Pl. 36: 14-16
57. *Arecipites* Wodehouse 1933 (Palmae) 山棕粉屬
A. taiwanensis Huang 臺灣山棕粉
58. *Couperipollis* Venkatachala & Kar 1969 (Palmae) 刺棕粉屬
C. taiwanensis C. L. Huang & T. C. Huang 臺灣刺棕粉 Pl. 14: 11-16
59. *Monosulcites* Cookson *ex* Couper 1953 (Palmae) 椰子粉屬
M. formosensis Huang 臺灣椰子粉
60. *Sabalpollenites* Thiergart in Raatz (1973) 1938 (Pandanaceae) 蘆巴棚棕櫚粉屬
S. taiwanensis Huang 蘆巴棚棕櫚粉
61. *Sparganiaceaepollenites* Thiergart 1937 (Sparganiaceae) 黑三稜粉屬
S. taiwanensis C. L. Huang & T. C. Huang 臺灣黑三稜粉 Pl. 14: 17-18
62. *Neotriangulipollis* Góczán, Groot & Krutzsch in Góczán, Groot, Krutzsch & Pacltova 1967 (Normapolles) 新三角粉屬
N. taiwanensis C. L. Huang & T. C. Huang 臺灣新三角粉 Pl. 14: 21-23
63. *Riestedtipollis* Krutzsch 1969 (Normapolles) 雷斯太德粉屬
R. polycolpites Krutzsch 雷斯太德粉 Pl. 14: 19-20

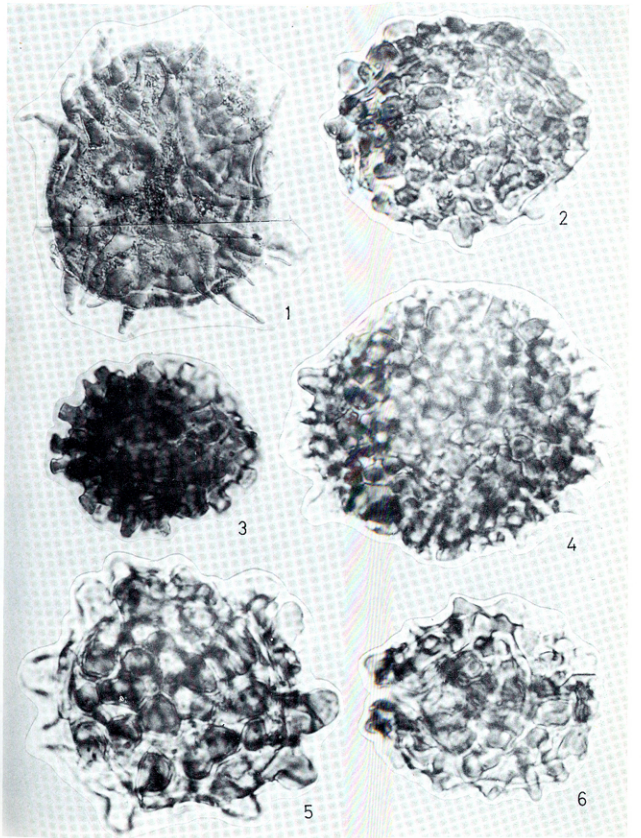

Plate 1. Figure 1, ×500; figures 2–6, ×1000.
1. *Conisporites taiwanensis* Huang & Huang (124-S); 2–6. *Corrusporis taiwanensis* Huang & Huang (124-S, 134-1L, 124-S, 124-S, 124-S).

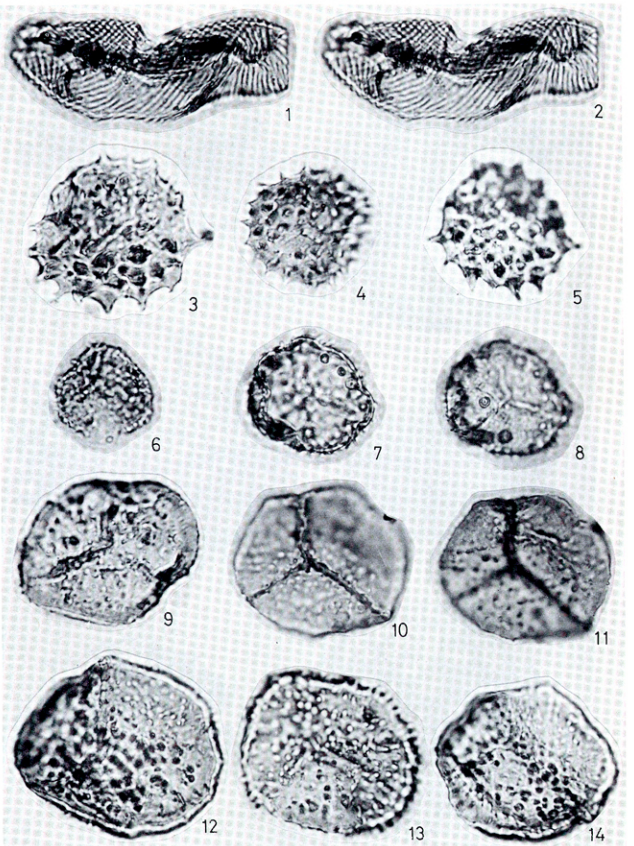

Plate 2. All figures, ×1000.
1-2. ***Striamonoletes digitatus*** Huang & Huang (11-1R); 3-5. ***Sphaerina taiwanensis*** Huang & Huang (9-1R, 68-1L, 75-2L); 6-8. ***Anthocerisporis taiwanensis*** Huang & Huang (K2-1R, 26-1L, 26-1L); 9-14. ***A. formosensis*** Huang & Tsou (42-3R, K6-4L, K6-4L, 74-2R, 53-1R, K4-1L).

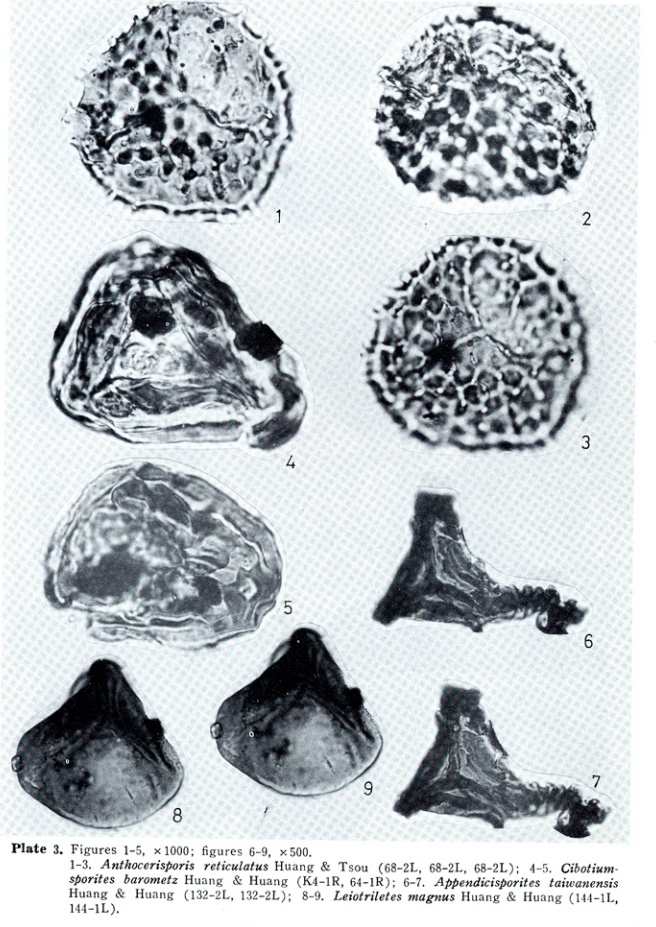

Plate 3. Figures 1-5, ×1000; figures 6-9, ×500.
1-3. ***Anthocerisporis reticulatus*** Huang & Tsou (68-2L, 68-2L, 68-2L); 4-5. ***Cibotiumsporites barometz*** Huang & Huang (K4-1R, 64-1R); 6-7. ***Appendicisporites taiwanensis*** Huang & Huang (132-2L, 132-2L); 8-9. ***Leiotriletes magnus*** Huang & Huang (144-1L, 144-1L).

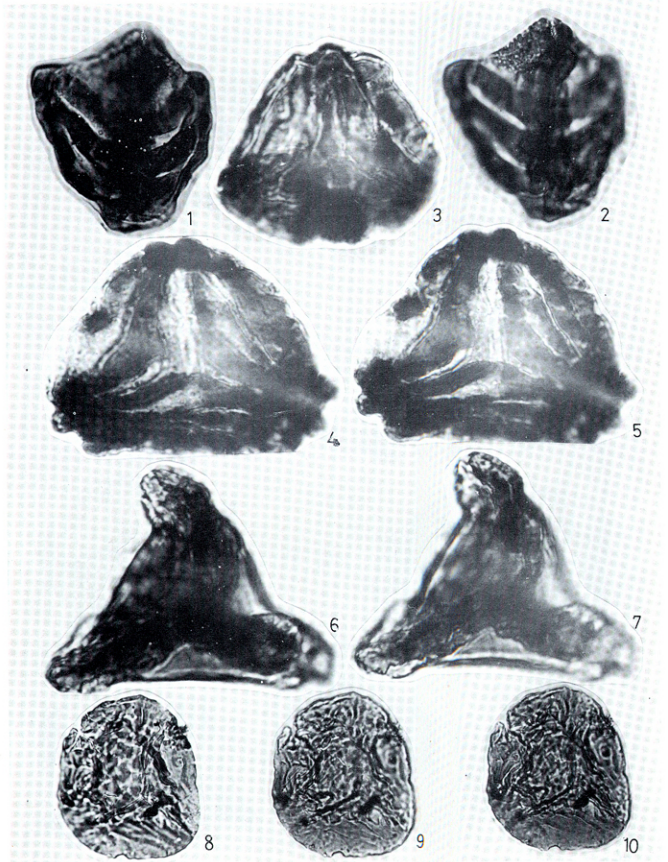

Plate 4. Figures 1-7, ×1000; figures 8-10, ×500.
1-5. ***Cicatricosisporites formosensis*** (Huang) Huang & Huang (142-2L, 142-2L, 81-1L, 31-1R, 31-1R); 6-7. ***Concavisporites colliculosus*** Huang & Huang (94-1L, 94-1L); 8-10. ***Lycopodiacidites infragranulatus*** Mädler (69-4R, 69-4R, 69-4R).

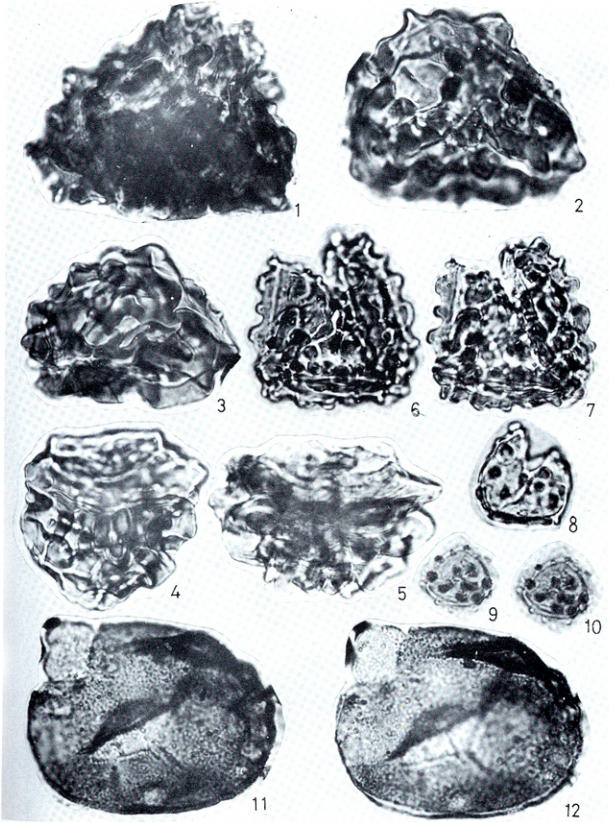

Plate 5. All figures, ×1000.
1–5. *Polypodiaceoisporites baculatus* Huang & Huang (83-1R, K6-3, 3-1L, 91-1R, 53-3L); 6–7. *Verrucingulatisporites baculatus* Huang & Huang (23-2L); 8–10. *Verrucopunctasporites taiwanensis* Huang & Huang (127-1L, 131-1R, 131-1R); 11–12. *Microreticulatisporites taiwanensis* Huang & Huang (146-1L).

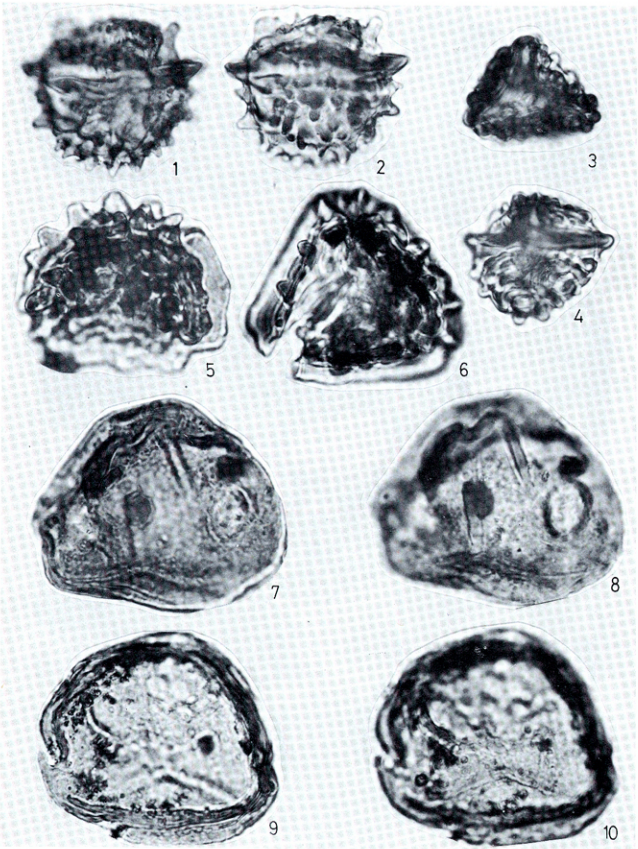

Plate 6. All figures, ×1000.
1-4. ***Polypodiaceoisporites ensiformis*** Huang & Huang (3-3L, 3-3L, 131-2L, 131-2L); 5-6. ***P. nipponicus*** Huang & Huang (94-2R, 49-3R); 7-10. ***Punctatisporites formosensis*** Huang & Huang (112-2L, 112-2L, 15-2L, 15-2L).

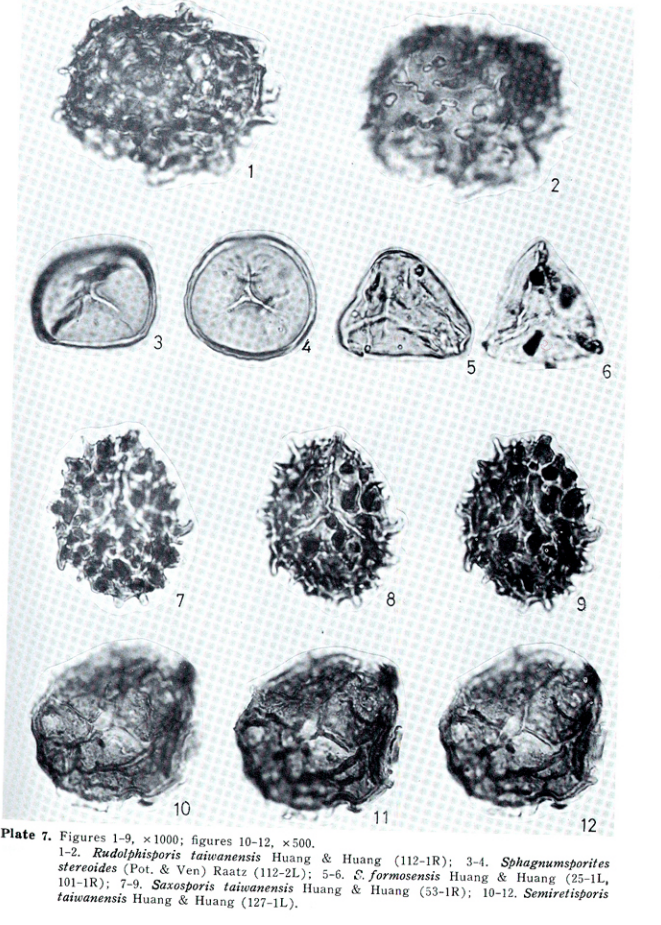

Plate 7. Figures 1-9, ×1000; figures 10-12, ×500.
1-2. ***Rudolphisporis taiwanensis*** Huang & Huang (112-1R); 3-4. ***Sphagnumsporites stereoides*** (Pot. & Ven) Raatz (112-2L); 5-6. ***S. formosensis*** Huang & Huang (25-1L, 101-1R); 7-9. ***Saxosporis taiwanensis*** Huang & Huang (53-1R); 10-12. ***Semiretisporis taiwanensis*** Huang & Huang (127-1L).

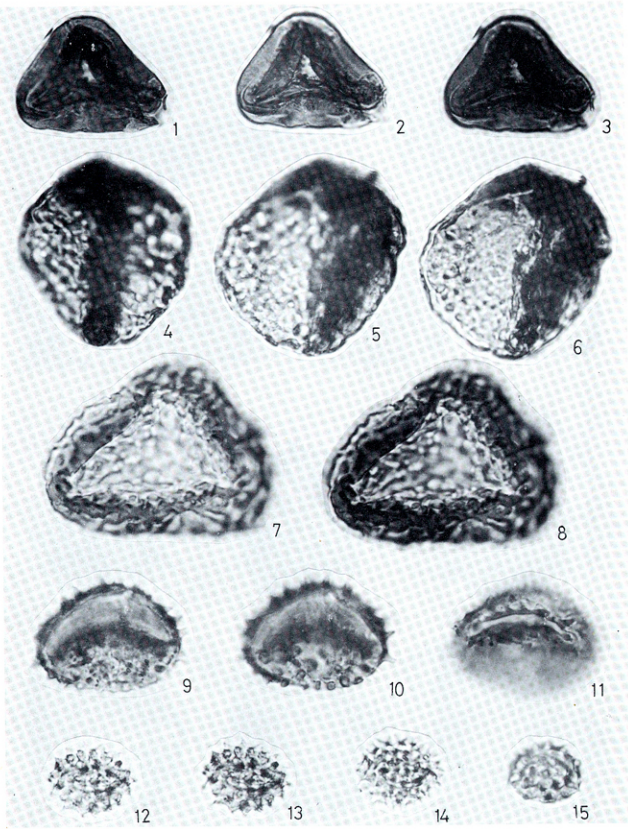

Plate 8. Figures 1-3, ×500; figures 4-15, ×1000.
1-3. ***Skarbysporites taiwanensis*** Huang & Huang (15-1L); 4-6. ***Triplanosporites rugulatus*** Huang & Huang (53-1R); 7-8. ***Verrucingulatisporites formosensis*** Huang & Huang (3-3L); 9-11. ***Monogemmites formosensis*** Huang & Huang (116-2L); 12-15. ***M. taiwanensis*** (76-1R, 75-1R, 75-1R, 112-2L).

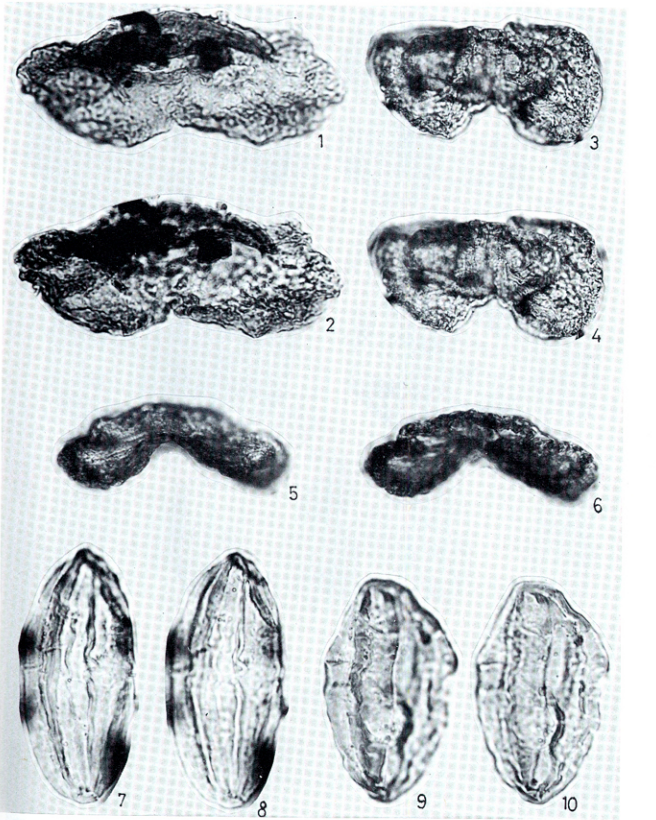

Plate 9. Figures 1–6, ×500; figures 7–10, ×1000.
1–2. ***Dacrydiumites magnus*** Huang & Huang (115-2L); 3–6. ***Podocarpidites conjunctus*** Huang & Huang (25-1L); 7–10. ***Ephedripites tertiarius*** Krtz. (K4-1R, K4-1R, 118-1R, 118-1R).

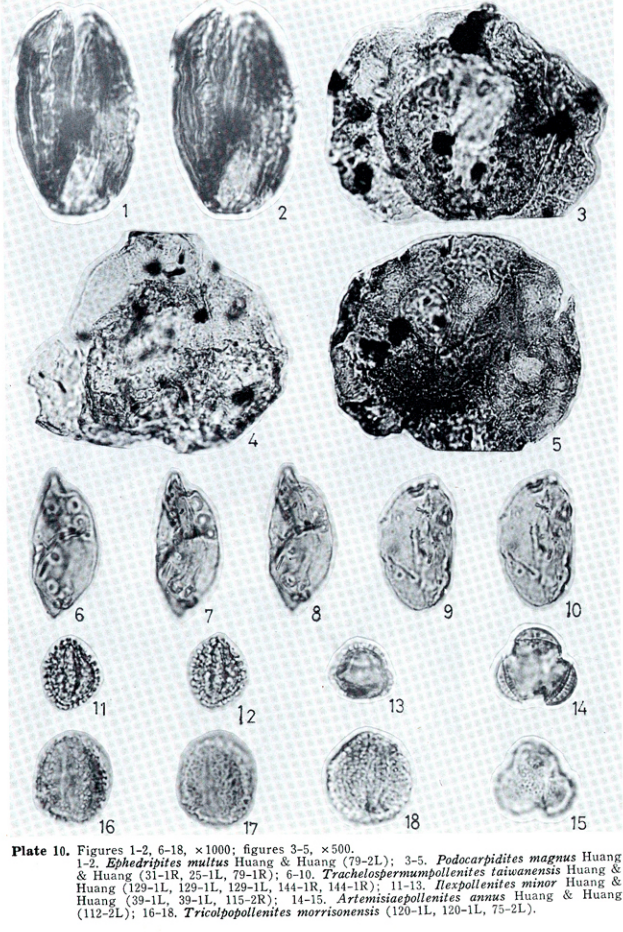

Plate 10. Figures 1-2, 6-18, ×1000; figures 3-5, ×500.
1-2. ***Ephedripites multus*** Huang & Huang (79-2L); 3-5. ***Podocarpidites magnus*** Huang & Huang (31-1R, 25-1L, 79-1R); 6-10. ***Trachelospermumpollenites taiwanensis*** Huang & Huang (129-1L, 129-1L, 129-1L, 144-1R, 144-1R); 11-13. ***Ilexpollenites minor*** Huang & Huang (39-1L, 39-1L, 115-2R); 14-15. ***Artemisiaepollenites annus*** Huang & Huang (112-2L); 16-18. ***Tricolpopollenites morrisonensis*** (120-1L, 120-1L, 75-2L).

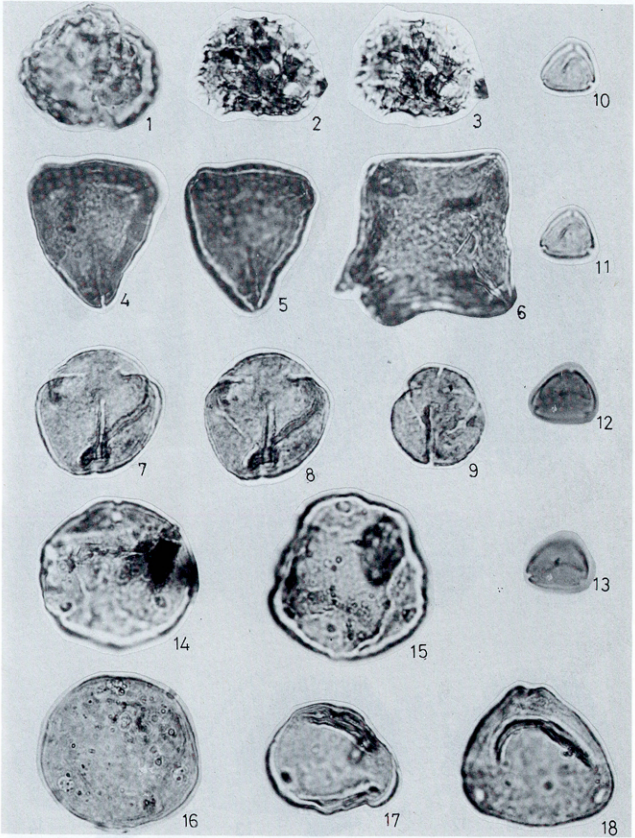

Plate 11. All figures, ×1000.
1. ***Hemisteptapollenites hyratus*** Huang & Huang (123-2L); 2-3. ***Cichoreacidites taiwanensis*** Huang & Huang (68-1L); 4-6. ***Stowakipollis taiwanensis*** (Huang) Huang & Huang (108-1L, 79-2R); 7-9. ***Wilsonipites communis*** Huang & Huang (74-2R, 74-2R, 64-1L); 10-13. 108-1L, ***Engelhardtioipollenites taiwanensis*** Huang & Huang (116-2R, 116-2R, 112-1R, 112-1R); 14-18. ***Caryapollenites taiwanensis*** Huang & Huang (85-1L, 21-1R, 53-2L, 35-1L, 15-2L).

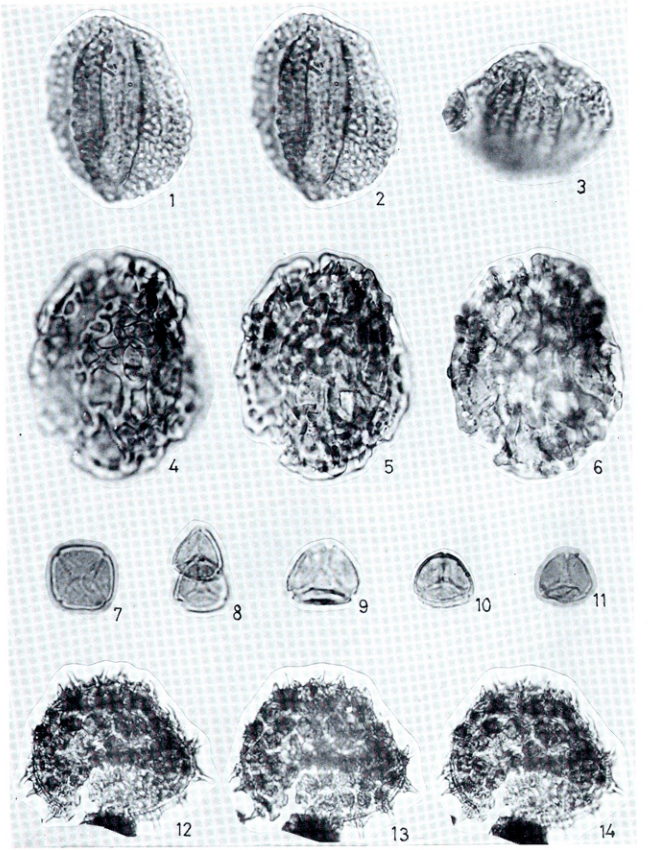

Plate 12. Figures 1–11, ×1000; figures 12–14, ×500.
1–3. ***Retihexacolpites taiwanensis*** Huang & Huang (120–1L); 4–6. ***Assamialetes taiwanensis*** Huang & Huang (125–2L); 7–11. ***Myrtaceidites taiwanensis*** Huang & Huang (124–1L, 112–1R, 11–1R, 81–2L, 116–1L); 12–14. ***Malvacearumpollis taiwanensis*** Huang & Huang (116–2L).

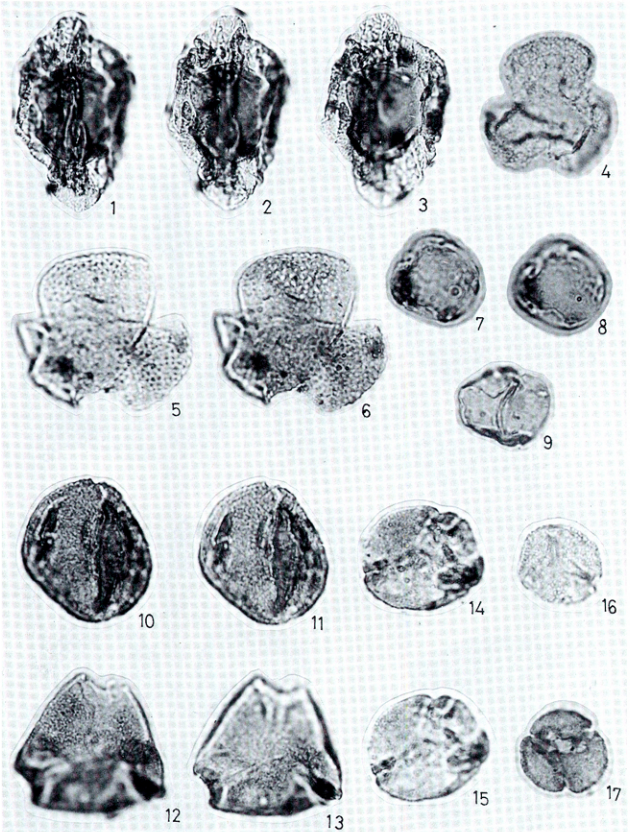

Plate 13. Figures 1-3, ×500; figures 4-17, ×1000.
1-3. ***Sporotrapoidites illingensis*** Kl. (25-1L); 4-6. ***Paraphlomipollenites taiwanensis*** Huang & Huang (123-1R, 101-1L, 101-1L); 7-9. ***Plantaginacearumpollis formosensis*** Huang & Huang (42-3L, 42-3L, 83-1L); 10-13. ***Margoaperturates taiwanensis*** Huang & Huang (83-1L, 83-1L, 112-2L, 112-2L); 14-17. ***M. hypoleucus*** Huang & Huang (75-1R, 75-1R, 127-2L, 123-1L).

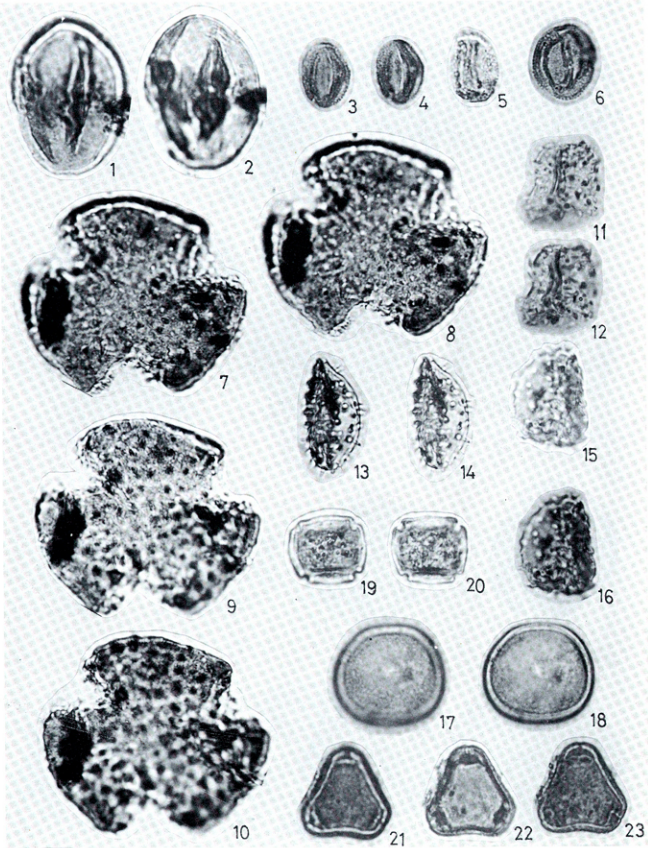

Plate 14. All figures, ×1000.
1-2. ***Rutaceoipollenites taiwanensis*** Huang & Huang (79-2L); 3-6. ***Tricolporopollenites asper*** Huang & Huang (131-1L, 131-1L, 101-1L, 68-1L); 7-10. ***Patriniapollenites taiwanensis*** Huang & Huang (64-2L); 11-16. ***Couperipollis taiwanensis*** Huang & Huang (116-1L, 116-1L, 105-1R, 105-1R, 120-1L, 120-1L); 17-18. ***Sparganiaceaepollenites taiwanensis*** Huang & Huang (3-1L); 19-20. ***Riestedtipollis polycolpites*** Krtz. (106-1L); 21-23. ***Neotriangulipollis taiwanensis*** Huang & Huang (105-1L).

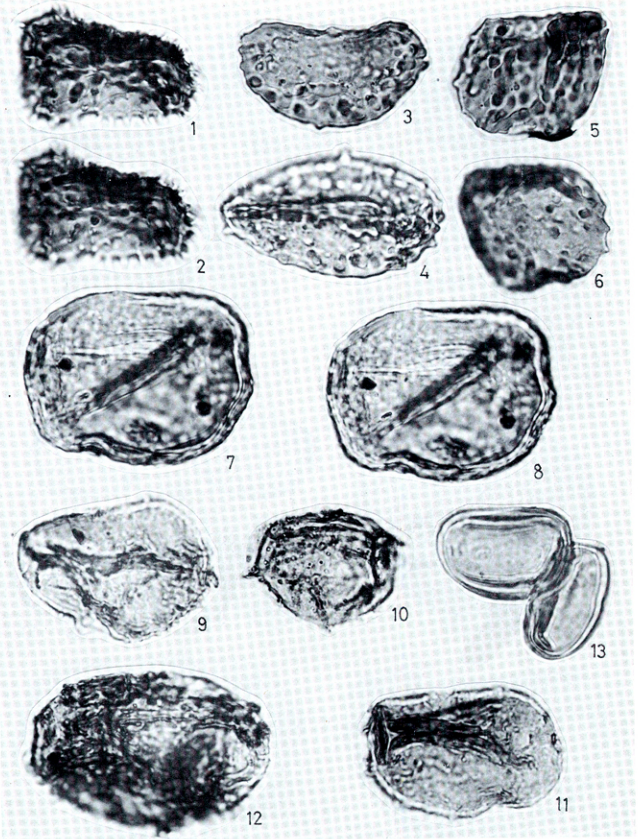

Plate 15. All figures, ×1000.
1–2. ***Echinosporis taiwanensis*** Huang (15-1L); 3–4. ***Gemmamonoletes oblongo-lunatus*** Huang (120-1R, 91-1R); 5–6. ***G. formosensis*** Huang (142-4L, 138-2R); 7–8. ***Extrapunctatosporis taiwanensis*** Huang (23-1L); 9–11. ***Perinomonoletes granulatus*** Huang (53-3L, 21-1R, 21-1L); 12. ***P. lato-reticulatus punctatus*** Huang (101-1L); 13. ***Laevigatosporites gracilis*** Wilson & Webster (79-2L).

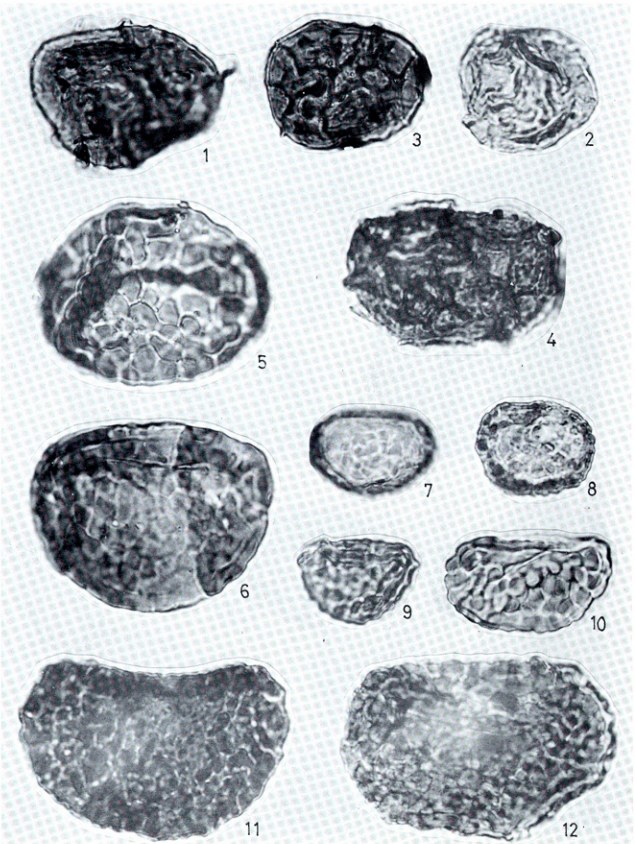

Plate 16. All figures, ×1000.
1-2. ***Perinomonoletes reticulatus scabrato-marginatus*** Huang (115-1L, 49-1L); 3-4. ***P. lato-reticulatus*** Huang (132-1R, 97-1L); 5-6. ***Verrucatosporites balticoides*** Huang (105-1L, 124-1L); 7-9. ***V. balticoides minor*** Huang (115-2R, 91-1R, 112-2L); 10. ***V. lunatus*** Huang (123-1R); 11-12. ***V. reniformis*** Huang (49-1R, 81-1L).

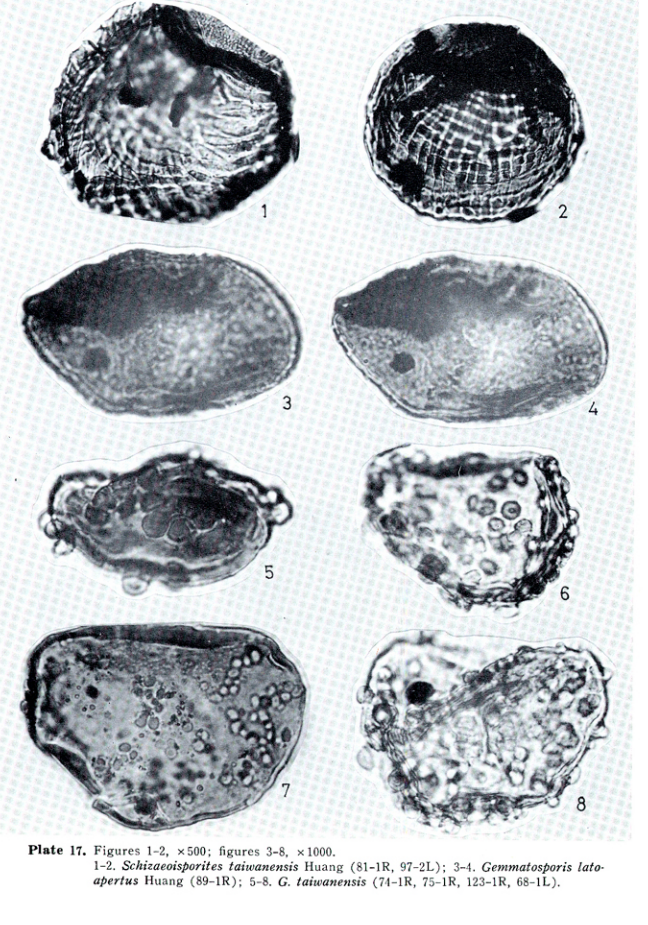

Plate 17. Figures 1–2, ×500; figures 3–8, ×1000.
1–2. *Schizaeoisporites taiwanensis* Huang (81–1R, 97–2L); 3–4. *Gemmatosporis latoapertus* Huang (89–1R); 5–8. *G. taiwanensis* (74–1R, 75–1R, 123–1R, 68–1L).

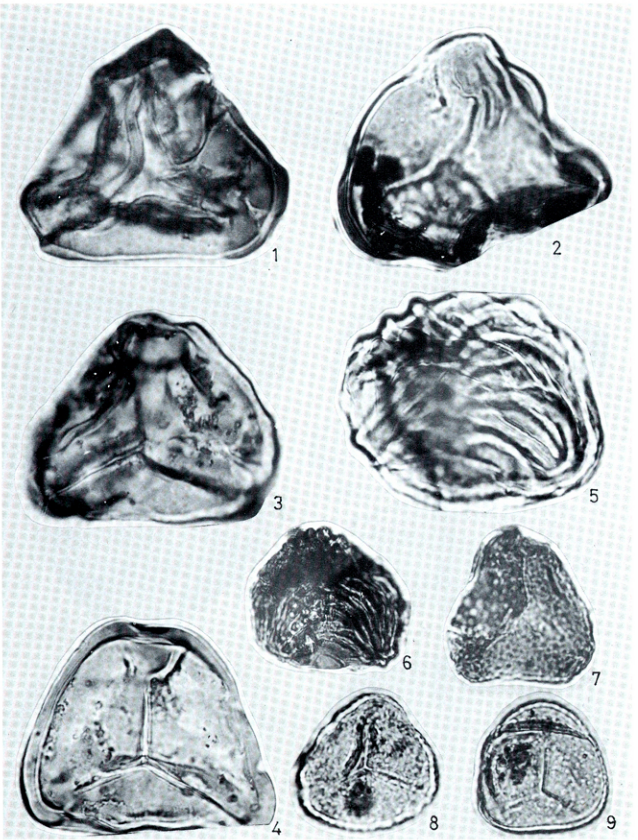

Plate 18. Figures 1-5, 7-9, ×1000; figure 6, ×500.
1-2. ***Cibotiumsporites cumingus*** Huang (116-1R, 105-1L); 3-4. ***Cingulatisporites taiwanensis*** Huang (120-1L, 124-S); 5. ***Cicatricosisporites taiwanensis*** Huang (53-3R); 6. ***C. australiensis*** (Cookson) Potonie (35-1L); 7-9. ***Foveotriletes serratus*** Huang (106-1R, 71-2L, 105-1L).

Plate 19. All figures, ×1000.
1-2. *Crassoretitriletes vanraadshooveni* G. H. M. (115-2L); 3-4. *Foveotriletes formosensis* Shaw & Huang (21-2L); 5. *Granulatisporites formosensis* Shaw & Huang (21-1L); 6-7. *Polypodiaceoisporites wallichianus* Huang (112-1L, 132-3R); 8-10. *P. emarginatus* Huang (124-1L, 131-2L, 144-1L).

Plate 20. All figures, ×500.
1-10. *Magnastriatites grandiosus* (Kedves et Sole de Porta) Duenas (101-2L, 101-2L, 94-2L, 97-1L, 85-S, 85-S, 23-1L, 112-1R, 112-1R).

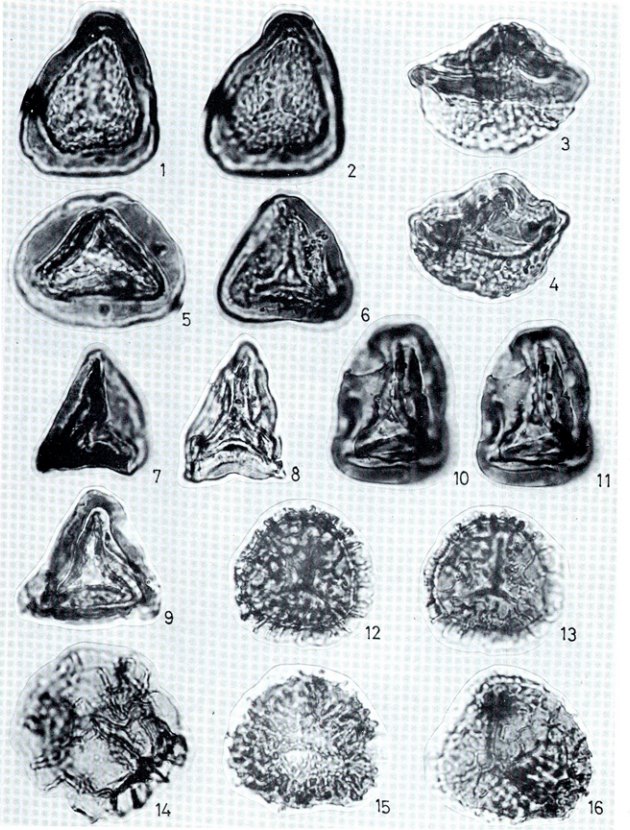

Plate 21. All figures, ×1000.
1-4. *Polypodiaceoisporites venustus* Huang (127-1R, 127-1R, 81-2L, 101-1R); 5-6. *P. setuloso-costulatus* Huang (68-2L, 144-1L); 7-9. *Pterisporis concavus* Huang (132-1L, 74-1R, 94-1L); 10-11. *P. taiwanensis* Huang (31-1L); 12-16. *Retitriletes taiwanensis* Huang (112-2L, 112-2L, 108-2L, 79-3R, 94-2R).

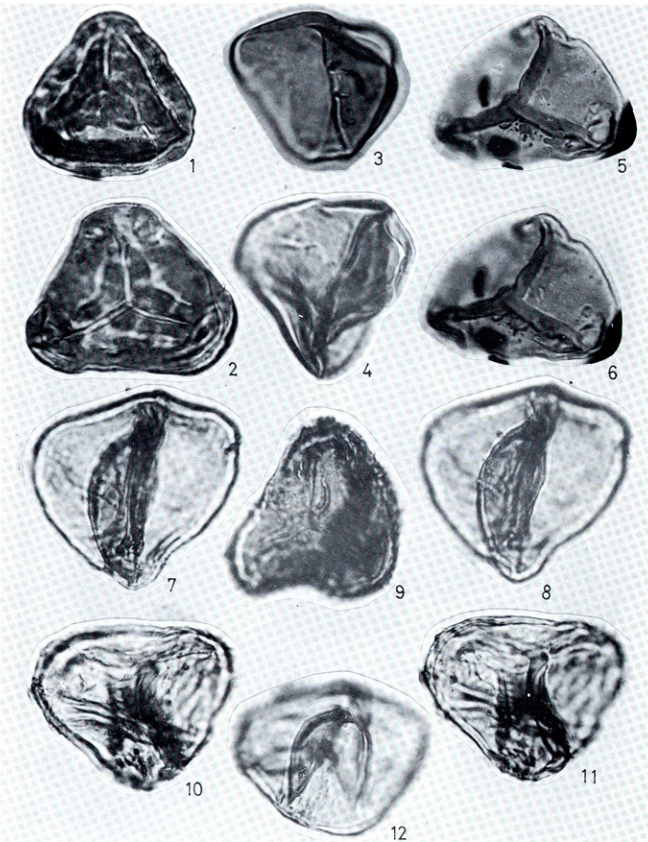

Plate 22. All figures, ×1000.
1-2. *Toricingulatisporites taiwanensis* Huang (81-1R, 74-1L); 3-12. *Toroisporis taiwanensis* Huang (120-1L, 53-1L, 125-2L, 125-2L, 105-1L, 105-1L, 74-1R, 21-1L, 21-1L, 115-2L).

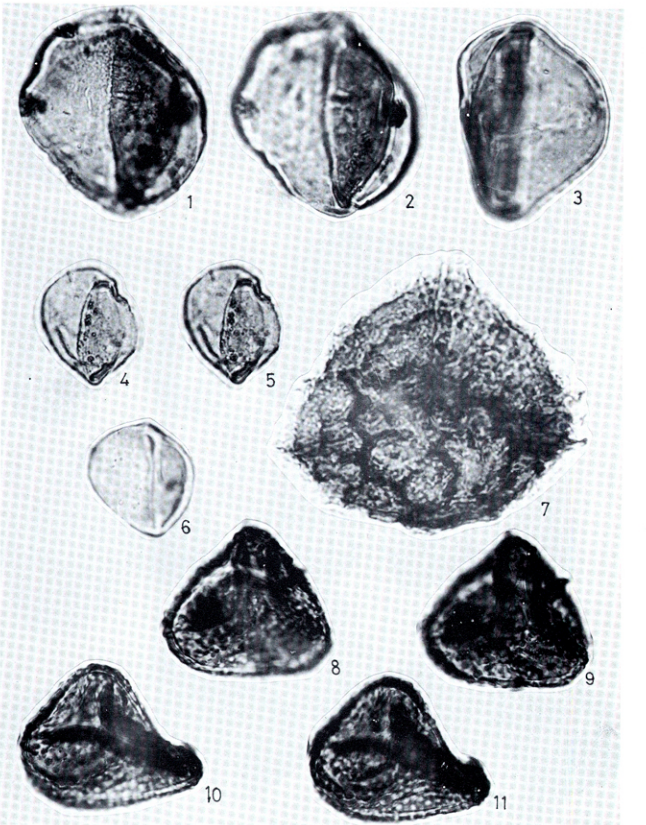

Plate 23. Figures 1-7, ×1000; figures 8-11, ×500.
1-3. ***Triplanosporites medius*** Shaw & Huang (K2-1L, K2-1L, 53-3R); 4-6. ***T. minor*** Shaw & Huang (K2-1R, K2-1R, 124-1R); 7. ***Perotriletes reticulatus*** Huang (85-S); 8-11. ***Verrucosisporites taiwanensis*** Huang (69-1R).

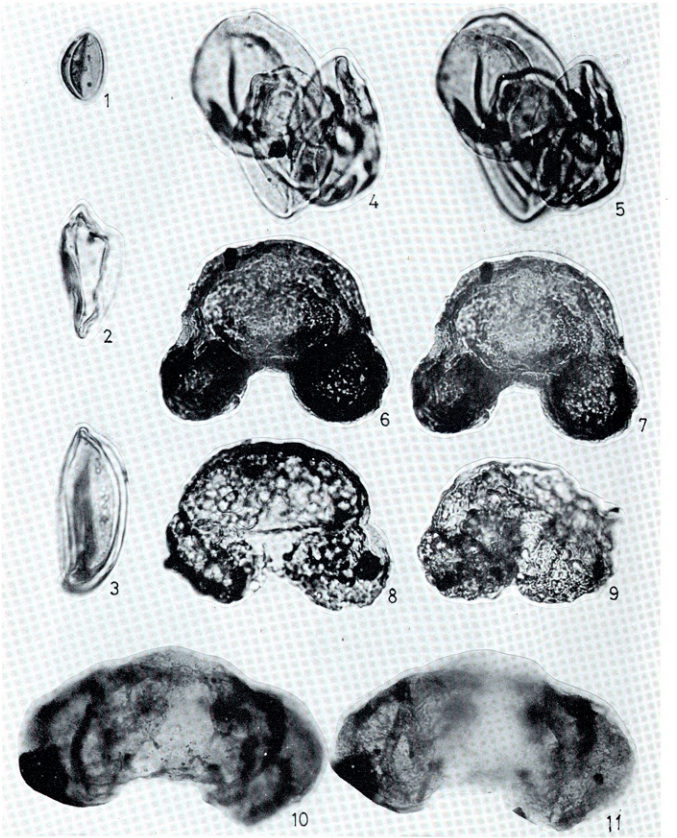

Plate 24. Figures 1-5, ×1000; figures 6-11, ×500.
1. ***Cycadopites ellipticus*** Huang (116-2L); 2-3. ***C. gracillis*** Krtz. (125-2L, 127-1R); 4-5. ***Classopollis taiwanensis*** Huang (3-3R); 6-9. ***Abiespollenites formosensis*** Huang (85-S, 85-S, 39-1L, 25-1L); 10-11. ***A. oblongus*** Huang (25-1L).

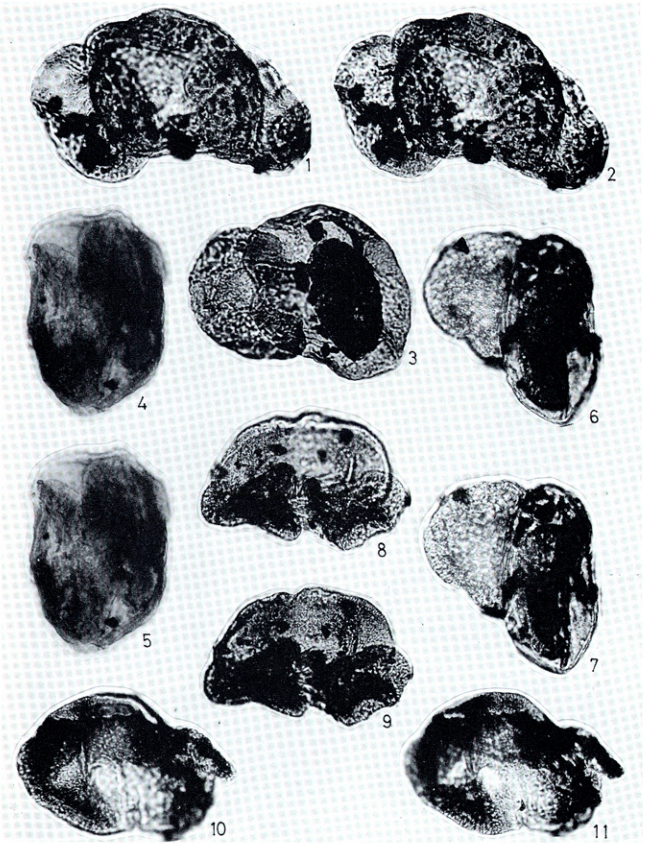

Plate 25. All figures, ×500.

1-3. ***Keteleeriaepollenites taiwanensis*** Huang (79-2L, 79-2L, 53-3R); 4-7. ***Longicorpuspollenites taiwanensis*** Huang (125-2L, 125-2L, 35-2L, 35-2L); 8-11. ***Piceapollis acutosaceatus*** Huang (35-2L, 35-2L, 53-1L, 53-1L).

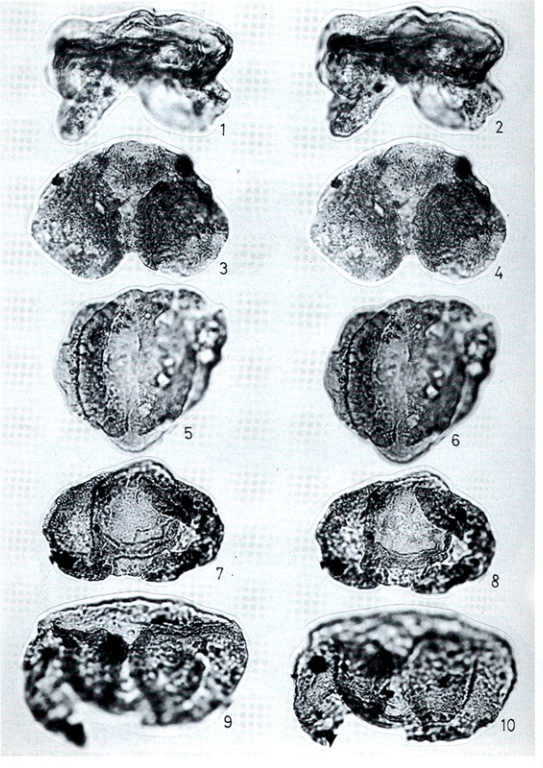

Plate 26. Figures 1–2, 5–6, ×1000; figures 3–4, 7–10, ×500.
1–2. ***Pityosporites oblongus*** Huang (K6–3L); 3–4. ***P. scabratus*** Huang (124–1R); 5–6. ***P. acutus*** Huang (120–1L); 7–10. ***P. zonalatatus*** Huang (53–2R, 53–2R, 23–1L, 23–1L).

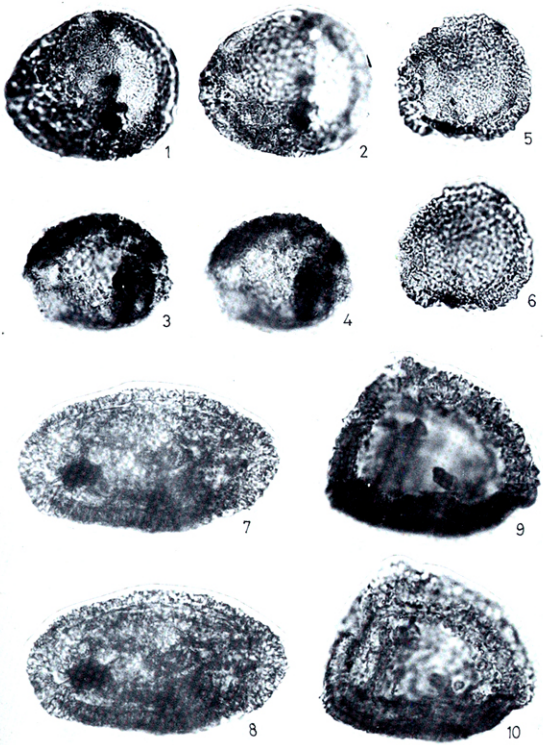

Plate 27. Figures 1-6, ×500; figures 7-10, ×1000.
1-10. ***Zonalapollenites chinensis*** Huang (3-3R, 3-3R, 125-2L, 125-2L, 25-1L, 25-1L, 124-1L, 124-1L, 134-1L, 134-1L).

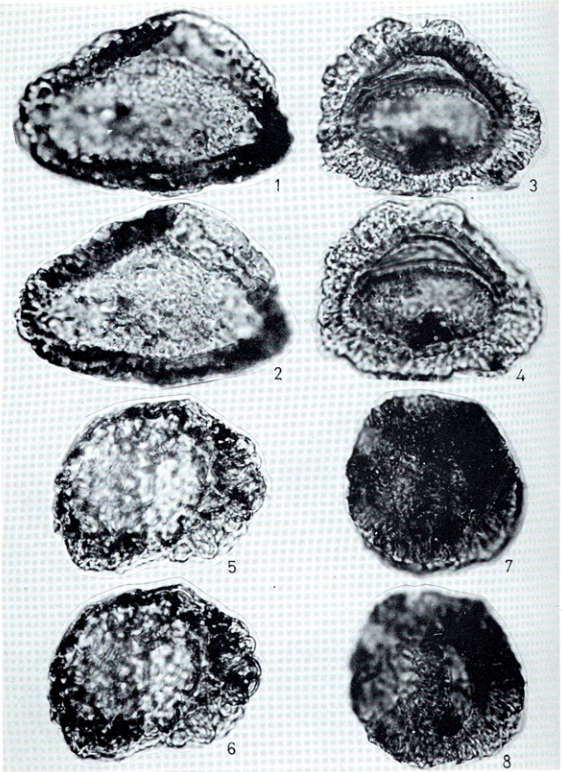

Plate 28. All figures, ×1000.
1-4. ***Zonalapollenites taiwanensis*** Huang (123-1L, 123-1L, 3-3L, 3-3L); 5-8. ***Dacrydiumites taiwanensis*** Huang (39-1R, 39-1R, 3-3L, 3-3L).

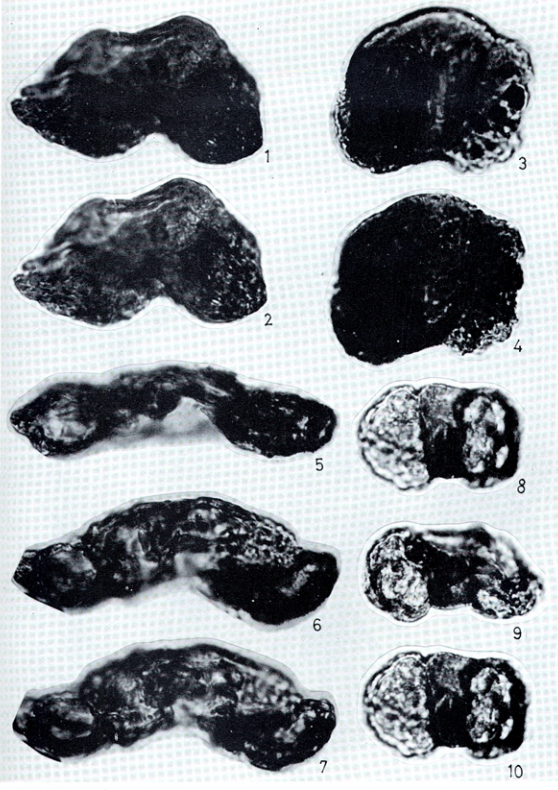

Plate 29. All figures, ×1000.
1-4. *Dacrydiumites taiwanensis* Huang (3-3L); 5-7. *Podocarpidites beugii* Huang (120-1L); 8-10. *P. taiwanensis* Huang (85-1R).

Plate 30. All figures, ×1000.

1-4. ***Podocarpidites taiwanensis*** Huang (123-1R, 123-1R, 81-2R, 81-2R); 5-8. ***Ephedripites ellipticus*** Huang (89-2L, 89-2L, 1-2L, 1-2L); 9-10. ***E. taiwanensis*** Huang (94-1L); 11. ***E. kuanyinshanensis*** Huang & Chaw (118-1L).

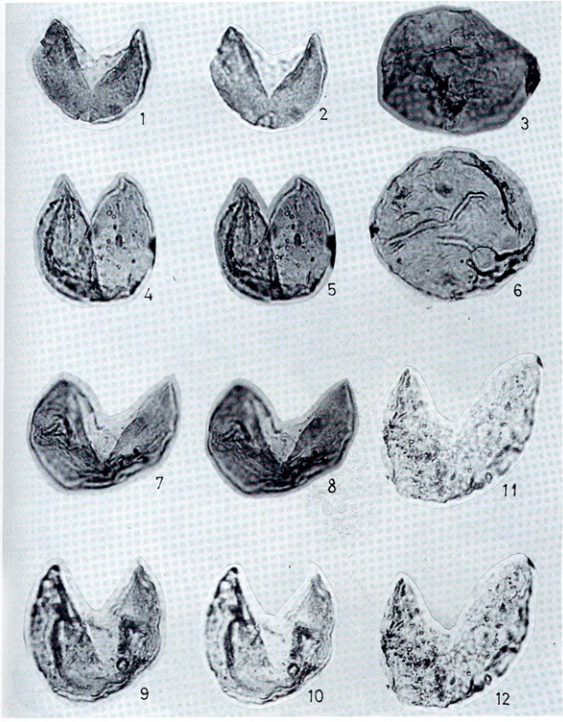

Plate 31. All figures, ×1000.
1-12. Taxodiaceae-Cupressaceae-Taxaceae (132-1R, 132-1R, 125-2L, 146-1L, 146-1L, 79-1R, 129-1L, 129-1L, 85-1R, 85-1R, 118-2L, 118-2L).

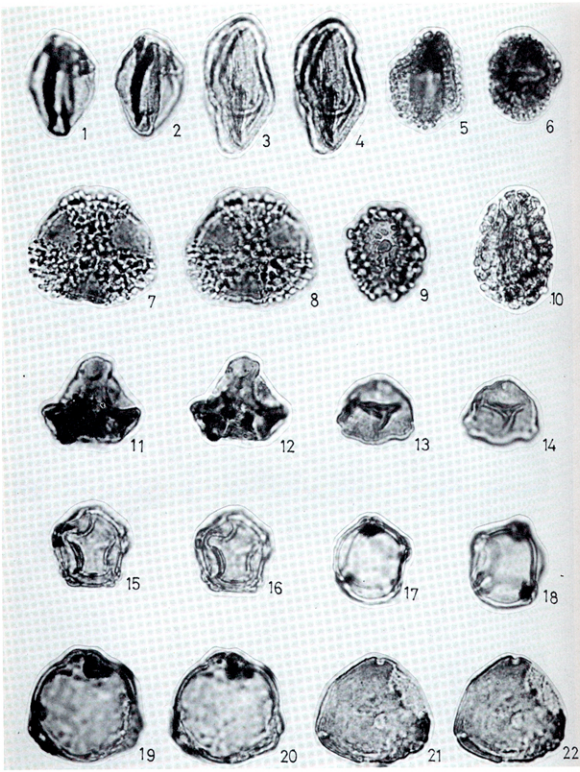

Plate 32. All figures, ×1000.
1-2. ***Tricolpopollenites ellipticus*** Huang (68-1L); 3-4. ***T. elongtus*** Huang (71-1L); 5-8. ***Ilexpollenites asprella*** Huang (124-1R, 3-3L, 42-1R, 42-1R); 9-10. ***I. kusanoi*** Huang (138-1L, K4-2L); 11-12. ***Alnuspollenites taiwanensis*** Huang (132-4R); 13-14. ***Trivestibulopollenites taiwanensis*** Huang (115-2R); 15-18. ***Alnipollenites formosensis*** Huang (74-1L, 74-1L, 127-1L, 127-1L); 19-20. ***Triatriopollenites taiwanensis*** Huang (112-1R); 21-22. ***Myricaceoipollenites megagranifer*** (Pot.) Pot. (39-3L).

Plate 33. All figures, ×1000.
1-2. *Loniceraepollis japonicus* Huang (75-2L); 3-6. *Chenopodiopollis taiwanensis* Huang (47-2L, 47-2L, 129-3L, 129-3L); 7-9. *Dichrocephalapollenites taiwanensis* Huang (118-1L, 118-1L, 1-2L); 10-12. *Elaeocarpollenites taiwanensis* Huang (131-2R, 131-2R, 131-2L); 13-16. *Tricolporopollenites taiwanensis* Huang (105-1L, 105-1L, 53-3R, 53-3R); 17-19. *Tricolporopollenites amygdalifolius* Huang (25-1L, 116-2R, 116-2R); 20-21. *T. minus* Huang (143-1R, 124-1L); 22-23. *T. perprolatus* Huang (125-3L); 24-25. *T. uraiensis* Huang (124-1L, 74-1L).

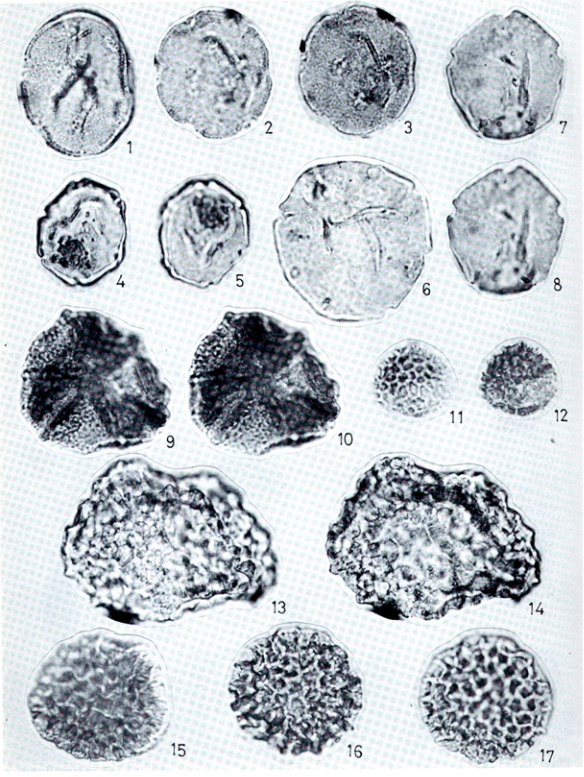

Plate 34. All figures, ×1000.
1-3. ***Peripollenites formosensis*** Huang (108-1L, 123-1R, 123-1R); 4-8. ***Polyatriopollenites taiwanensis*** Huang (39-3L, 39-3L, 85-1L, 123-1R, 123-1R); 9-10. ***Margocolporites vanwijhei*** Huang (115-1L); 11-12. ***Polygonacidites minus*** Huang (112-2L); 13-14. ***P. vulgaris*** Huang (25-1L); 15-17. ***P. densoreticulatus*** Huang (64-1L, 108-1L, 108-1L).

Plate 35. All figures, ×1000.
1-2. ***Gardeniapites taiwanensis*** Huang (120-1L); 3-5. ***Symplocacites caudata*** Huang (85-1L); 6-7. ***S. modesta*** Huang (124-1L); 8-11. ***Tricolporopollenites repens*** Huang (79-1L, 143-2L, 143-2L, 143-2L); 12-17. ***Tiliaepollenites taiwanensis*** Huang (31-1L, 31-1L, 3-3R, 3-3R, 106-3R, 31-1R).

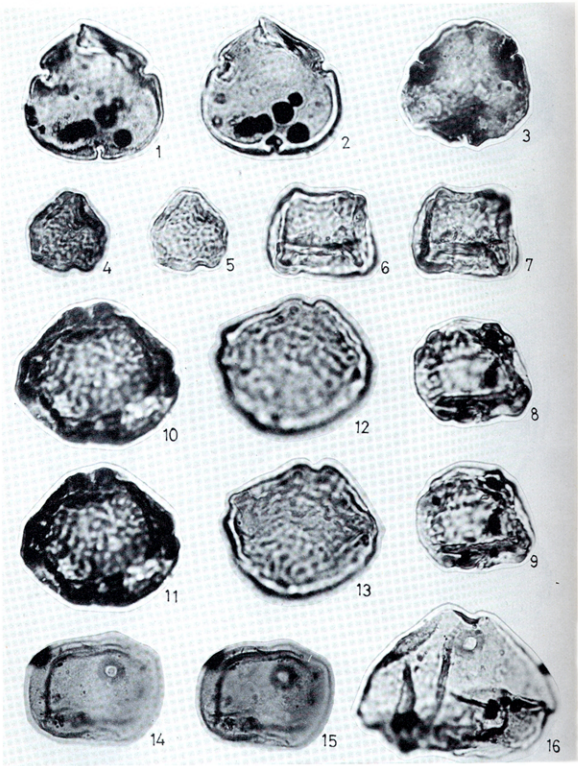

Plate 36. All figures, ×1000.
1-3. *Tiliaepollenites taiwanensis* Huang (23-2L, 23-2L, 85-3L); 4-9. *Ulmipollenites taiwanensis* Huang (143-1R, 143-1R, 124-1L, 124-1L, 47-1L, 47-1L); 10-13. *Zelkovaepollenites taiwanensis* Huang (131-3L, 131-3L, 15-1R, 15-1R); 14-16. *Graminidites glabratus* Huang (116-1L, 116-1L, 118-2L).

Plate 37. All figures, ×1000.
Moss spores: 1-2. (79-1R); 3-4. (25-1L); 5. (142-1L); 6. (131-1L); 7-8. (11-1R); 9-10. (124-1L); 11. (112-1L); 12. (108-1L); 13. (127-1L); 14-15. (142-4L); 16-17. (131-2L); 18-19. (116-2L); 20. (116-2L); 21-22. (115-2L).

Plate 38. All figures, ×1000.
Fungal elements: 1-2. (138-4L); 3. (129-1L); 4. (125-3L); 5. (116-3L); 6. (116-3L); 7. (116-2L); 8. (116-1L); 9. (125-3L); 10-11. (64-2L); 12-13. (39-1L); 14. (125-2L); 15. (129-1L); 16. (116-1L); 17-18. (105-1L); 19. (K6-1L); 20-21. (94-1L); 22. (116-2L); 23. (132-1R); 24-25. (138-4L); 26. (47-1R); 27. (64-2L); 28-29. (K1-1R).

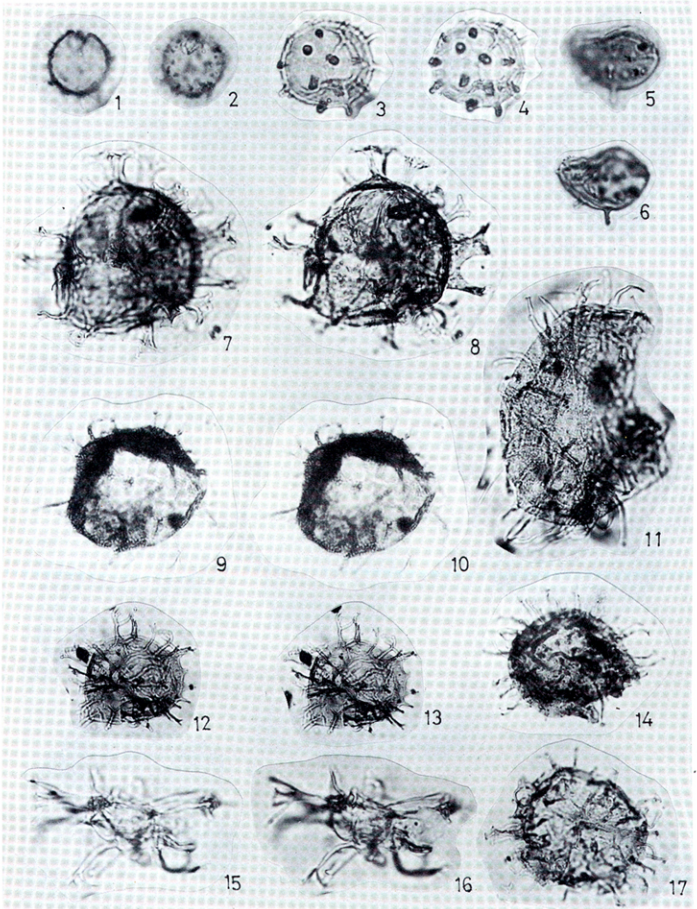

Plate 39. Figures 1-6, 15-16, ×1000; figures 7-14, 17, ×500.
Dinoflagellates: 1-2. (15-1L); 3-4. (97-1L); 5-6. (129-3L); 7-8. (74-1R); 9-10. (68-S); 11. (105-1L); 12-13. (79-2L); 14. (85-S); 15-16. (131-2L); 17. (85-S).

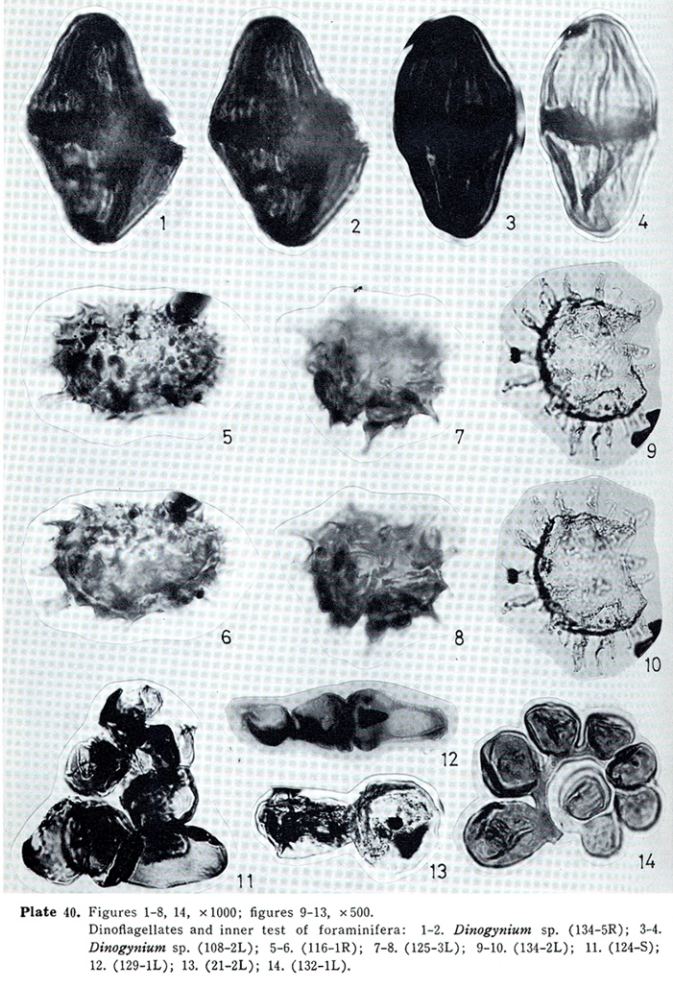

Plate 40. Figures 1–8, 14, ×1000; figures 9–13, ×500.
Dinoflagellates and inner test of foraminifera: 1–2. ***Dinogynium*** sp. (134-5R); 3–4. ***Dinogynium*** sp. (108-2L); 5–6. (116-1R); 7–8. (125-3L); 9–10. (134-2L); 11. (124-S); 12. (129-1L); 13. (21-2L); 14. (132-1L).

臺灣上新世之孢粉分析(II)

—雲水溪剖面

黃志林 黃增泉

摘 要

臺灣上新世的地層除了北部苗栗縣出礦坑有連續性出露外，在嘉義地區也有許多出露良好的剖面可供研究。本研究的主要目的爲銜接現有更新世及中新世之孢粉生物地層資料，以供日後地層對比及臺灣植羣史研究所需之基本資料。

分析臺灣西南部濁水溪剖面57個樣品，記述了6個新屬，52個新種，5個新記錄種及2個新組合種。新發現之被子植物花粉與其他地區記錄比較，其出現之時序多能相符，而馬錢科之灰莉粉及敗醬科之敗醬粉則尚未有確定之記錄以資對照。隆脊條紋孢型之向心極面網紋，未發現於現生類似孢型中，其可能爲一較原始之特徵。

將歸屬於冷溫及暖溫熱植羣兩類之孢粉型或生長環境相似之孢粉組合，製作孢粉圖譜。冷溫植羣與暖熱植羣有相對的變化，以其變化爲主，劃分了七個孢粉帶。氣候變化在第二帶有趨暖的可能，第五帶有濕熱的環境，第六帶變爲乾冷，在第八帶氣溫有劇烈的冷——熱——冷變化，可能已屬更新世。

屬於白堊紀晚期及第三紀早期孢粉之再堆積及裸棘農藻之出現，推論濁水溪剖面之地層堆積時有白堊紀海相沉積地層之出露。